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Art. 2. Quædam Palmæ Panamenses

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GENTES HERBARUM

Occasional Papers on the Kinds of Plants

By L. H. BAILEY

2. Certain Palms of Panama.

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FIG. 20. CANOPY OF SCHEELEA against the dark woods. Inflorescence is shown, spathe above, spadix or flower-cluster beneath.—*Scheelea zonensis.*

NOTE.—As in former issues, new binomials are marked † for accommodation of the bibliographer; n. tr. is *translatio nova,* or one form of "new combination" (Gent. Herb., vol. i, p. 8).

Eyeh.
The Author
3-23-1932

ARTICLE 2. CERTAIN PALMS OF PANAMA

In June and July, 1931, opportunity arose to collect plants on Barro Colorado Island in the Canal Zone, with particular attention to the palms, and excursions were made to other parts of the Zone and neighboring territory. The results of these collections are presented on the following pages. The account does not pretend to be complete for Panama or even for the Canal Zone, but the species on Barro Colorado were attentively assembled although some of the material representing bactrids not in flower or fruit is yet incapable of exact identification. On the Island, all the trails and parchas, as well as other parts and a considerable length of the shore line, were covered; yet it is too much to expect that the total palm flora of Barro Colorado was disclosed. With the exception of a few coconuts (not included here) all the palms observed on the island are native.

The regions of Phytelephas, or ivory palms, remote from the central Zone, were not visited. The inquirer will find treatment of these odd palms by O. F. Cook in Inventory No. 27, Bulletin 242 of Bureau of Plant Industry, United States Department of Agriculture, p. 68 (1912: *P. Seemanni*) and in Journal of the Washington Academy of Sciences, iii, 139-143 (1913: general account of distribution and morphology, with descriptions of five new species).

Apparently the palm flora of Panama is not extensive. We have only one list, that of Berthold Seemann, Flora of the Isthmus of Panama which comprises 200 pages in the Botany of the Voyage of H. M. S. Herald during the years 1845-1851. The palms occupy less than ten pages, under date 1854, and the list is thirteen genera with twelve named species including the coconut, and comprising also Phytelephas which he places in a separate family and to which he devotes much space as well as three plates. For the Canal region itself we have the excellent Flora of the Panama Canal Zone by Paul C. Standley, Contributions from the United States National Herbarium, vol. 27, 1928. The palms in this treatment are 22 genera including the introduced coconut and the Roystoneas; there are also subsequent notes of palms by Standley in the published lists of the plants of Barro Colorado Island. These are not large inventories for a country the size of Panama lying in the torrid zone. Few collections of important material are in the museums, and citations of the Panama region are surprisingly few in systematic accounts on the palms of tropical America. Apparently Panama is largely yet a *terra incognita* in respect to palms, although the Canal Zone area is undoubtedly now fairly well covered. Aside from Phytelephas apparently no new species of palms have heretofore been described from Panama.

It is interesting that Seemann did not include Chamædorea and Raphia, genera established long before his time; nor Œnocarpus. He includes *Oreodoxa regia* (now known as *Roystonea regia*) saying that it is "common in the Province of Panama, about Cruces, Gorgona, and San Juan, forming entire woods." This statement recalls the fact that Humboldt speaks of *Oreodoxa regia* occurring at Panama. Recently it has been reported that a native Roystonea has been discovered in Panama; a plant so recorded now growing at the Experimental Gardens at Summit is Œnocarpus. Cruces, Gorgona and San Juan, mentioned by Seemann, are now under Gatun Lake, but in the forests in that vicinity Œnocarpus is at present abundant nor did I see a Roystonea there. Moreover, Seemann speaks of his palm as bearing the vernacular "maquenqui"; this is the name still borne by Œnocarpus. Outside the islands in the Everglades of southern Florida, we do not yet know of any Roystoneas, the "royal palms" of English-speaking peoples, certainly native on any mainland.

The *Thrinax argentea* in Seemann (which in the course of events would now be Coccothrinax) is undoubtedly *Acanthorrhiza Warscewiczii*. Aside from southern Florida we recognize no Coccothrinaces outside the West Indies; and also only one continental Thrinax, which is reported in Honduras as well as in Cuba.

Beyond these cases, there remains only *Bactris simplicifrons* unaccounted for in some way in the present paper; Seemann records this palm "in woods, Southern Darien." Under the Barbosan treatment this palm becomes *Amylocarpus simplicifrons*.

The flora of the Isthmus appears to be characteristically Central American; hence, as Standley writes, "the botanist familiar with even a country so distant as Guatemala will find little that is strange to him." The Canal Zone palms confirm this relationship as far as we are able to judge from the imperfect knowledge of this family in the general region.

The present study has been made possible by the facilities on Barro Colorado Island placed at the disposal of the author and his daughter, and gratitude is hereby expressed to the management of the Institute for Research in Tropical America for these privileges. Everyone connected with the Laboratory and all others on the Zone with whom we came in contact were helpful and ready. Particular mention is to be made of Mr. James Zetek of Balboa, Resident Custodian, whose industry, cooperative spirit, enthusiasm and devotion are well known to every person who has had the advantage of the Barro Colorado experience. Appreciation extends to Donato and Silvestre, care-takers who know the woods. Aid in collecting of material at the time and since has been rendered by James Edgar Higgins, Director, and Walter R. Lindsay, of the Canal Zone Experiment Gardens at Summit; plants in the Gardens were at our disposal and

materials of native palms of the neighborhood not in season at the time have been supplied by them as the palms matured.

The author has availed himself of the indispensable aid of Dr. Max Burret of Berlin-Dahlem and hereby acknowledges his indebtedness for critical comparisons with type and authentic material preserved there in the Botanisches Museum.

In the lack of field studies of palms in that geographical region, absence of authentic material from adjacent South America and from Central America, deficiency in assembled literature, together with the general uncertainty in palm botany, one hesitates to describe new species from Panama; yet one must begin. The author has consulted the available material in this country, has received photographs of historic specimens in Europe, and has submitted the proposed new species to Dr. Burret for independent judgment. A number of doubtful plants and points still remain, but the writer cannot expect to explore that territory again. He hopes there is enough in this brief preliminary study to be suggestive.

The palm groups treated in this paper are the following:

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SCHEELEA

The most conspicuous native tall field and woods palm tree of the Canal Zone is generally known as *Attalea gomphococca* and *A. Cohune*. It was entered as *Attalea Cohune* by Seemann in 1854. Some of it, at least, turns out, however, to be an undescribed Scheelea.

Whether more than one species is involved in these palm trees of Panama is, of course, subject for future study. I have examined trees in several places on the Zone and find them to be the same, but the diagnosis of the new palm in this article is drawn particularly from the plant of Barro Colorado Island (type) and vicinity.

† **Scheelea zonensis**, spec. nov. § Dialphocaryum, Burret. Figs. 20-23.

Palma alta robusta, gregi *S. Liebmannii* relata: flores staminati ochroleuci vel straminei, angusto-clavata petala 10-15 mm. longa, sepala angustiora et aliquid longiora quam petala: sepala florum pistillatorum longi-attenuata, petala excedentia: fructus circa 6 cm. longus si siccus rostrum et perianthium includens, et fere 3 cm. crassus, sepala angustiora et aliquid longiora quam petala: semen unicum.

Big massive unarmed tree, irregularly monœcious, in the open usually with a short thick stock covered with leaves, and petiole-bases in which other plants grow, but in the forest the bole becoming 30 feet or more and 4-5 feet in circumference at 3 feet from the ground with bare but irregularly

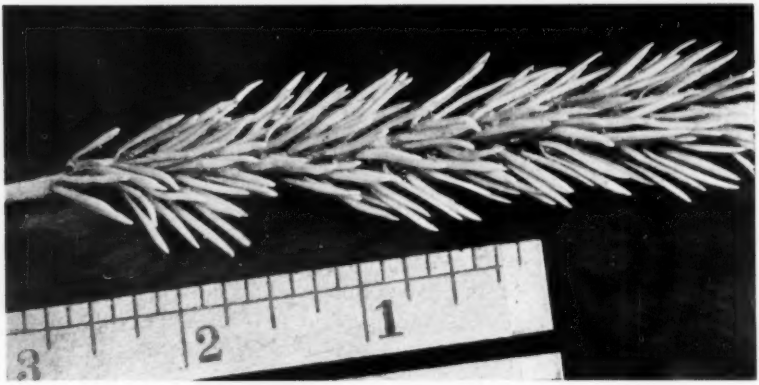

Fig. 21. Staminate strand of *Scheelea zonensis*.

ringed or corrugated surface; crown or top broad-vasiform with long-ascending and curved leaves that stand more or less edgewise and numerous drooping pinnæ; head in old trees comprising many heavy hanging trusses in different stages of fruit-bearing accompanied by the dead dry woody sheaths or spathes, all issuing from the axils of the ponderous leaves: leaves short-stalked, the blade to 20 feet long; petiole 1-2 feet, 3-4 inches across and much broader at enlarged base, rounded on lower side but flat-trough-like above with sharp upstanding edges, passing into a stout rachis double-furrowed above but higher up in the leaf becoming narrowed sidewise with acute keel and flattish opposite surface, the scores of pinnæ taking off from the two sides; pinnæ stiff, entire, glabrous, regularly spaced, hanging and the basal ones ribbon-like, attached to rachis by the entire width but becoming expanded or flat a few inches away from rachis and the base therefore trough-shaped with lower surface in the trough, 3-4 feet long, to $1\frac{1}{2}$-$2\frac{1}{2}$ inches broad, long-tapering to a narrow indefinitely bifid apex which may split deeply with age, midrib strong and upstanding on upper surface, finely striate and cross-veined: spathe woody and deeply many-furrowed, becoming brown, base contracted to a long portion or handle (Fig. 6, Fasc. i), apex narrowed into a slender flattish bayonet or

point, the whole 6-9 feet long and perhaps 8 or 10 inches thick at middle just before anthesis, dehiscing on lower side, in flower standing more or less horizontal above the declined great inflorescence or spadix, but hanging with age even after fruit falls; inflorescence a simple rachis bearing numerous pendent side-branches 1 foot and more long loaded with cream-colored staminate flowers and a few large pistillate ones at base, attractive to tiny insects, the whole flowering part of spadix to 26 inches or so long; staminate flowers 10-15 mm. long, consisting of only minute calyx envelopes, 3 cylindrical club-shaped slender perianth parts or petals and 6 very short anthers, soon caducous and exposing the sterile bare ends of the branchlets; pistillate flowers much larger, with 6 prominent tapering envelopes in two series, of which the outer (calyx) is the longer, single pistil bearing 3 stigmas about equalling the perianth: fruit oblong, narrowed to a beak, 2-2⅜ inches long and one-half or somewhat more as broad, glabrous, dull orange at maturity with a firm and hardly fleshy exterior, earth-brown and finely striate when dry; fruiting perianth about ¾ inch long, the outer parts (sepals) narrower than the inner and somewhat longer; nutlet thick and bony, imbedded in a tough hard fibrous husk, containing a single seed with solid continuous albumen; trusses in fruit to 4 feet more or less, hanging on a heavy stout peduncle.

FIG. 22. ONE PISTILLATE AND TWO STAMINATE FLOWERS of *Scheelea zonensis* (×1½ or 2).

This Scheelea belongs to Burret's section Dialphocaryum and is related to *S. Liebmannii*, Becc. of Mexico, *S. Preussii*, Burr. of Guatemala, and *S. brachyclada*, Burr. of eastern Peru. Dr. Burret has kindly compared material of *S. zonensis* with those species, and makes these contrasts: The fruit is about twice greater than that of *S. Liebmannii* and *S. Preussii*. It reminds one of *S. brachyclada* but in the fruiting perianth of that species the petals are conspicuously longer than the sepals, the staminate flowers are smaller, the fruits are longer and relatively less thick.

Striking feature of this Canal Zone Scheelea is the variation in sex character of the flower-clusters. Three types of clusters may be distinguished: (1) Practically all pistillate, not showy in anthesis; (2) all staminate; (3) nearly all staminate but with a few well-developed pistillate flowers at base of strands. Mr. Lindsay has made observations for me on these points, and writes that "all three types of flower-clusters may be borne on the same tree. This is specially true of the young trees, as I did not find the three types on a single old tree. I have not found a healthy tree that showed a tendency to produce all staminate flowers." In my own observation I was struck with the fact that some trees are abundantly fruitful while

others of similar age and bearing many remains of spathes were sterile. Some trees are showy in bloom and others are not. The meaning of these differences is subject for unhasting study on the spot when trees are in fresh bloom. One notes variations in fruits and flowers.

Profusely staminate clusters are showy as they burst, the male flowers being a lively light cream-color; blossoms soon become darker and stramineous as they quickly fall; dried preserved material is very dark brown.

FIG. 23. FRUITS OF THE ZONE SCHEELEA, somewhat over-size. *Scheelea zonensis.*

Associated with the staminate clusters of Scheelea as they open were great numbers of a very small beetle simulating the color of the flowers. These with other insects and mites taken in palm flowers were turned over to Dr. J. Chester Bradley of Cornell University who submitted them to specialists. The beetle in the Scheelea flowers was determined by L. L. Buchanan of the United States Bureau of Entomology as a Derelomus, neither of the two species of the Biologia Centrali-Americana, either undescribed or a South American species.

Four genera comprise an American group of heavy palms of the Cocoineæ, very similar in general appearance: these are Attalea of Humboldt

Bonpland and Kunth 1815; Maximiliana of Martius 1826; Orbignya of Martius according to Endlicher 1837; Scheelea of Karsten 1856. The group was monographed by Burret in 1929 (in Notizblatt des Botanischen Gartens and Museums zu Berlin-Dahlem) with the following results as to species: Attalea 17 species in South America (mostly Brazil) including the doubtful *A. Cohune* of Honduras; Maximiliana 9 species in South America and West Indies; Orbignya 19 species in South America; Scheelea 40 species mostly in South America but a few in West Indies, Mexico and Central America. By some authors Scheelea has been included in Attalea, but there are good marks of separation, or, as Burret writes, "*Attalea* und *Scheelea* sind gut geschiedene und natürliche Gattungen". In Attalea the perianth parts of staminate flowers are flat or lanceolate and stamens mostly many; in Scheelea the parts are terete or cylindric and stamens only 6; and there are other contrasts.

The generic name Scheelea, established by Karsten in 1856 (Linnaea, xxviii, 263-4), commemorates the German chemist Scheele, who lived and worked in Sweden.

The genus Maximiliana is distinguished by absence of showy petals in staminate flowers, these parts being small or minute. The other three genera are also separated from each other primarily on characters of the staminate flowers. In Attalea and Scheelea the long anthers are straight and not contorted, although in dried material they may have a slight twist but if so always longitudinally; Orbignya, on the other hand, has the anthers distinctly spiralled, or irregularly winding (meandriform), or curled laterally, sometimes twisted into a ball. For the purposes of this paper Burret has drawn the contrasts between these three genera as he now defines them:

A. Antheræ mæandriformiter contortæ: stamina 6-∞. 1. *Orbignya*

B. Antheræ normales.

a. Flores ♂ petalis planis, plus minus latis: stamina 6-12. 2. *Attalea*

b. Flores ♂ vivi petalis teretibus, carnoso-subulatis: stamina 6. 3. *Scheelea*

The plant intended as *Attalea gomphococca*, Martius, is undetermined, the species having been founded on an unidentified fruit. The nativity was given originally as Central America, but Burret indicates its likeness to South American Scheeleas, and he transfers the name to that genus. The name *Attalea Cohune* is commonly attached to planted palms, usually without verification. The true Cohune is now considered to belong to another genus: *Orbignya Cohune*, Dahlgren in Standley, Tropical Woods (Yale School of Forestry), No. 30, 2 (1932); Burret in Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem, xi, 689 (1932); whether it is planted in the Canal Zone I do not know.

The name *cohune* is a vernacular in Central America for a kind of palm nut; Martius made it a Latin specific name (three syllables) in Attalea; and Sereno Watson in 1886 described a *Bactris Cohune* (which Standley has recently put into Astrocaryum), called in Guatemala Warree Cohune "from the resemblance of its fruit in shape to those of the *Attalea*, and in their bristly covering to the 'warree' or white-lipped peccary of the country."

RAPHIA

The African genus Raphia was established by Ambroise Marie François Joseph Palisot de Beauvois (1752-1820), French naturalist, in his illustrious folio, Flore d'Oware et de Benin en Afrique, vol. i, 1804, founding also two species; and the diagnoses were again published in the old Journal de Botanique, vol. ii, 1809. Palisot had important relations with Oware and the Benin region bordering the Gulf of Guinea in western tropical Africa and he traveled extensively elsewhere, some of his journeys being in North America. The singular cone-like fruits of the Raphia palms had long been known and various names had been applied to them; by pre-Linnæan writers they had been called Palma-pinus, and by post-Linnæan authors they had been described under Sagus, a generic name now abandoned. Our author is known to North American botanists chiefly for his important work on grasses, being cited as Beauv. (Beauvois). He is commemorated in the genus Palisota of the Commelinaceæ.

Two Raphias were described by Palisot de Beauvois, *R. vinifera* and *R. pedunculata*, the former with an oblong and the latter with a broad nearly pyriform fruit, both represented in colored plates. Martius, writing in his monumental Historia Naturalis Palmarum, recognized three species, one of them American. The recent monographer, 1910, the late Odoardo Beccari, recognizes twenty species and several varieties, of which nineteen species are African (Webbia, vol. iii). The raffia palm (*R. Ruffia*) is indigenous in Madagascar, the others in western and equatorial Africa; *R. Ruffia* has been planted in other countries and it is on cultivated or introduced plants that Beccari supposes the *Raphia nicaraguensis* of Oersted (from Nicaragua) to have been founded. The Raphias are celebrated for their enormous leaves, those of the raffia palm of Madagascar said to reach a length of 65 feet and to be the largest in the vegetable world.

A Raphia native in equatorial America has long been known. It was described by Martius in 1824 as *Sagus tædigera* (cone-bearing: Latin, *tæda*, a pitch-pine), later transferred by him as *Raphia tædigera*. Whether the single American Raphia is distinct from the original *R. vinifera* of Nigeria has long been in doubt. As early as 1876 Drude suggested it might be a variety of *vinifera* and later writers have considered it to be the same as the African species. One would hardly expect an Amazonian palm to be the same species as a Nigerian. Beccari, however, with more material

at his disposal than others have had, regards them as distinct species, on characters of both flowers and fruits; this conclusion I follow, and call the American plant *Raphia tædigera*.

The species *R. tædigera*, according to Beccari, inhabits the paludose and inundated country in the estuary region about the River Amazon, where it is known as *jupati*. Alfred Russell Wallace, in his notable little book, Palm Trees of the Amazon and their Uses (1853), p. 43, writes interestingly of this palm tree:

"This is one of the most striking of the many noble Palms which grow on the rich alluvium of the Amazon. Its comparatively short stem enables us fully to appreciate the enormous size of its leaves, which are at the same time equally remarkable for their elegant form. They rise nearly vertically from the stem and bend out on every side in graceful curves, forming a magnificent plume seventy feet in height and forty in diameter. I have cut down and measured leaves forty-eight and fifty feet long, but could never get at the largest. The leaflets spread out four feet on each side of the midrib. They are rather irregularly scattered and not very closely set; they droop at the tips and have weak spinules along the margins.

"The stem does not generally exceed six or eight feet in height and is about a foot in diameter, clothed for some distance down with the persistent sheathing bases of the leaf-stalks and the numerous spinous processes which proceed from them.

"This is the only American species of the genus, and it inhabits exclusively the tide-flooded lands of the Lower Amazon and Pará rivers, being quite unknown in the interior. When descending from the Rio Negro to Pará in the summer of 1852, I observed some of our Indians who had made the voyage before, pointing out this tree to their less travelled companions as one of the curiosities of the lower country."

This striking palm is not treated in the great Sertum Palmarum Brasiliensium by Barbosa Rodrigues.

In his Flora of the Panama Canal Zone, Standley states that Raphia "is said to grow in some places on the Atlantic slope," and "is reported to range from Brazil to Nicaragua, besides occurring in Africa." He adds that in Nicaragua this palm is said to be called "holillo"; as this is the vernacular under which Oersted records his *R. nicaraguensis* and as *nicaraguensis* is declared by Beccari to be introduced *R. Ruffia*, there is doubt about the Nicaraguan occurrence. There appear to be no authentic records or specimens of the occurrence of the American species in the Republic of Panama. It is one of the undiscovered or unrecognized palms in Central America. Its habitat in swamps has probably caused it to be overlooked.

While on Barro Colorado Mr. Zetek brought to me an inquiry from Dr. D. P. Curry of the Canal Zone Board of Health as to the identity of a

striking palm he had seen some years ago in the Mojinga and about which he had not been able to obtain information. A drawing Dr. Curry had made on the morning newspaper disclosed the fruit as the undiscovered Raphia. An excursion was therefore planned into the great Mojinga swamp bordering the River Chagres below the Gatun dam notwithstanding it was in the wet season and the region was more or less flooded. The party comprised Dr. Curry, William Komp of the Board of Health, Charles A. Roach, Sanitary Inspector, and Major Dunham of the Army Medical Staff. A police launch took us in the morning from the dam down the Chagres and delivered us at a bank where the swamp could be entered, and then waited farther down the river until we should emerge late in the afternoon. The condition of the swamp was indeed memorable and the day was rainy; there were no trails and the way had to be cut through the dense dark growth by two strong natives with machetes by direction of compass; but Dr. Curry had well remembered the location and the palm was found. It grows in great clumps, at first a mass of impressive ascending-arching leaves, then trunks arising that may be 25 feet and more in height and 1 foot in diameter at the base, with many splinter-like shreds on the sheaths. The leaves on mature trees are majestic, uniformly pinnate; one leaf, including petiole and blade, was 40 feet long and it was apparently not the largest one we saw; the petiole was 6-8 inches in diameter near its base, rounded underneath and concave above. Leaflets or pinnæ are one or two inches apart subopposite on the rachis and are therefore very numerous; they reach 4 feet or more in length and more than 2 inches broad, glabrous except for scales or scurf on the midrib underneath, midrib elevated above and with two or three prominent primary veins either side and indistinct secondary ones between, margins with small sharp inconspicuous spicules pointing toward apex and one-half inch more or less apart. Fruit-clusters were in abundance; one spadix-branch we measured was 7 feet long. (Fig. 24). The great stiff many-bracted new spadices, several feet long, arising from among the leaves, showed flower-hands just emerging from their sheaths, the flowers not yet evident. The old fruit-clusters represented each of the hands or branches of the spadix, with the bare scarred fingers on which the staminate flowers were borne still protruding. The handsome fruits (Fig. 25) are short-oblong with truncate and cuspidate apex, 2-2¾ by 1½ inches, glossy green becoming brown, with flat-appressed smooth plane lorics or scales bearing dark brown edges and indistinct median line and pointing toward the base rather than the apex. The cohering scales form a thin shell inclosing another integument in which is a single large oblong wrinkled nut; albumen deeply intruded by sinuses from the walls. Breathing-roots were prominent, slender, projecting a few inches above the water. On our return from

the Mojinga on the launch we passed trees standing in the high water of the Chagres, which we could have collected from the boat without the necessity of climbing them.

In his account of the Amazon palm Wallace states that the stem does not generally exceed 6 or 8 feet in height, and speaks of it as if it were single or solitary, as indeed he illustrates it. He says the petiole is cylindrical. Martius states that the caudex is 6, 8 or 10 feet tall at the most and these dimensions are repeated by Beccari; neither one speaks of gregarious trunks. These are various divergencies from my observation of the plant in Panama. Whether these differences are significant I do not know. Spruce, well known for travels on the Amazon, speaks of Wallace's portrait of *Raphia tædigera* as "very successful."

Before leaving for Panama on this journey, Dr. Alexander F. Skutch of Baltimore had sent me an account of a

FIG. 24. LONG FLOWER ARMS of *Raphia tædigera*, the hands or clusters of flowers just emerging from the bracts or spathelets. These strands are taller than a man, hanging high in the tree.

visit to a natural stand of Raphia near Almirante in western Panama, Province Bocas del Toro, and subsequently he sent me photographs, and also specimens and additional notes. It is presumably the same species. With his permission I extract from his letters and notes a description of the Bocas Raphia: "In the swamps occupied by Raphia the species forms a most impressive plant formation. The trees, with trunks a foot thick and 50 or 60 feet high and great plumed fronds of about the same length, grow in practically pure stands on the swampy land. There is almost no undergrowth beneath the lofty canopy of leaves, but the marshy ground is entirely covered with the slender erect breathing roots of the palm growing so densely as almost to remind one of a sward of some brown wiry grass. The heavy pendent spadices reach a length of 10 feet and must take many months to mature their fruits. The United Fruit Company railroad runs through an extensive swamp of Raphia about twenty miles from Almirante, about midway between Farm 6 and the town of Guabito on the Costa Rican border. There is another noteworthy stand in the abandoned land behind the Company's Farm 1 (next to Farm 6), somewhat drier but for that reason more accessible.

"It is very common in Bocas del Toro province. There are many small local stands along the railroad all the way from Almirante to Guabito. Each stem of Raphia flowers once and dies after maturing its fruit, but the life of the plant is continued by the suckers of all ages which sprout up from the base and replace it. The spadix appears from between the leaves at the apex of the trunk, and is devoid of a spathe. Only a single terminal spadix is formed but this branches into four or five primary divisions at the point which, to an observer on the ground, is still hidden by the bases of the leaves. The branches at first stand upright, but eventually bend over and hang down on different sides of the stem, separated from each other by the leaves. Thus there appear to be four or five independent spathes, each 8 or 10 feet long, which, however, is not actually the case.

"Measurements of *Raphia tædigera* from Farm 1, near Almirante, Panama, April 14, 1929: circumference of trunk denuded of leaf-bases at breast height, 51 inches; estimated height of trunk, 50 feet; measured length of a fallen leaf (probably not largest), 47 feet, breadth 10 feet; pinnæ 5-5½ feet long by 2-3 inches broad; petiole 4 inches thick; germinating seeds showed great variation in size, ranging from 7 x 3.5 cm. and 6 x 2.7 cm. to 4.5 x 3 cm. and 4.8 x 2.8 cm.; another seed not germinating 8 x 4.5 cm. (the orange-colored inner fruit coat is much eaten by peccaries)."

In the National Herbarium, Smithsonian Institution, are pieces of a fruit of Raphia, a "swamp palm" from Limon, Costa Rica, collected by F. L. Stevens.

These various occurrences of Raphia are assumed to be the same species as that growing in the Amazonian delta region. The fruits I took in the

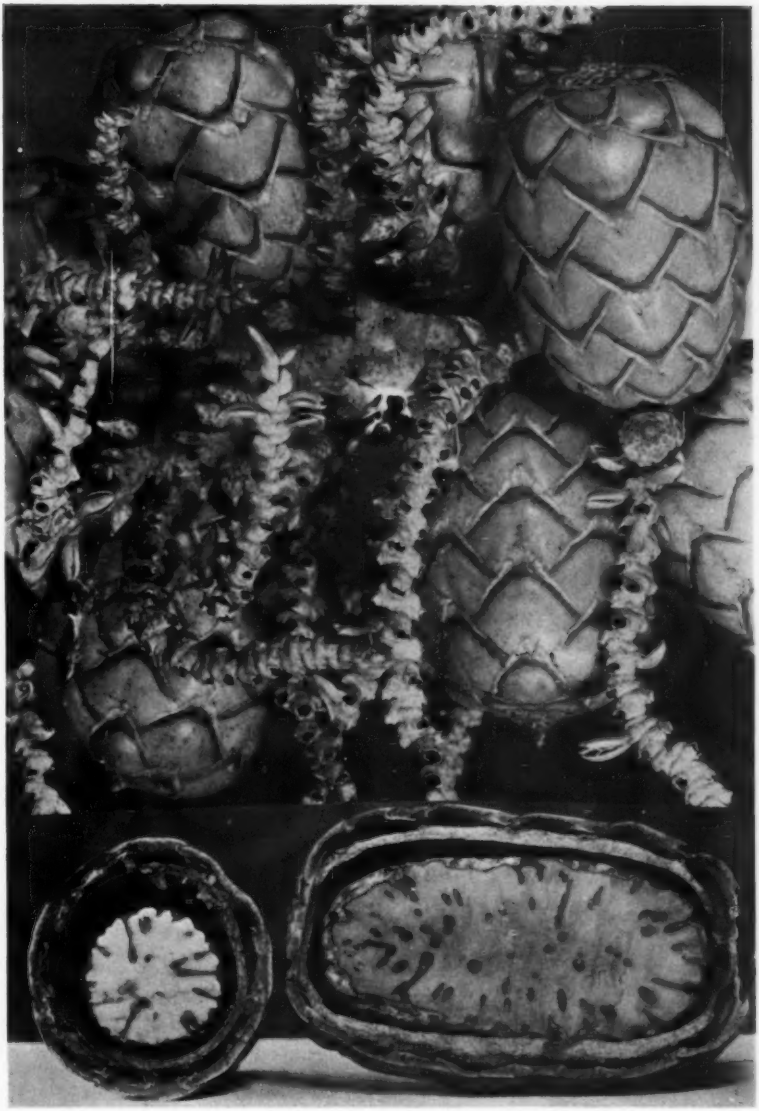

FIG. 25. RAPHIA FRUITS. Staminate axes still remain in the upper picture. *Raphia tædigera*. Natural size. Large fruits at bottom are from the Almirante Station (Skutch).

Mojinga swamp compare well with Martius' colored portrait of *tædigera* in Historia Naturalis Palmarum, ii, t. 48, with the picture of fruit in Wallace, in Flora Brasiliensis, and in Beccari's account in L'Agricoltura Coloniale, t. vi (1910). I have seen no material from the Amazon country, however.

Our present systematic understanding of the American Raphia may be displayed as follows:

Raphia tædigera, Martius, Hist. Nat. Palm. iii, 216 (1838).
Sagus tædigera, Martius, Hist. Nat. Palm. ii, 54, t. 45, 48 (1824) (the former figure apparently not designative).
R. vinifera var. *tædigera*, Drude in Martius, Fl. Bras. iii, pt. ii, 287, t. 61, fig. 1 and 62, fig. 1 (1882); in Engl. & Prantl, Naturl. Pflanzenf. ii, abt. 3, 44 (1889).
R. vinifera, Auth., not Beauv.

Marshes and inundated lands, lower Amazon region; presumably northward on the Atlantic side to Costa Rica and perhaps Nicaragua, but this needs verification.

Before leaving Raphia something more may be said about the case of *R. nicaraguensis*, Oersted in Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjöbenhavn, 1858, 52 (1859). In Drude's treatment of the palms of Brazil in 1882 (Flora Brasiliensis, iii, part ii) the Nicaraguan plant is referred to *R. vinifera* and a picture is given of a fruit of "var. nicaraguensis" from "America centrali" (p. 555). On an earlier page (288) he refers it directly to *R. vinifera* var. *tædigera*. Beccari in his extended monograph in 1910 considers the plant to be *R. Ruffia* introduced from Africa, basing his opinion on the specimens in Copenhagen; these specimens were only foliar parts, with no fruits.

Oersted gives a brief Latin diagnosis of his *R. nicaraguensis* and then the following account in Danish: "Of this tribe (Lepidocaryinæ) I have found only one species of the genus Raphia, which is only a little different from *R. tædigera* Mart., but nevertheless seems to be a distinct species and appropriately may be called *R. nicaraguensis*, since it probably does not occur outside Nicaragua. It is distinguished from *R. tædigera* by the leaves, the pinnæ of which stand closer to each other, all have the same direction and lack thorns in the margins. In addition the innermost perianth segment (Spathellula) is not cut out at the tip, and the outer perianth is larger in proportion to the inner; but since the flowers on the specimens collected by me are not fully developed, I shall here confine myself to indicating these differences and leave it to future investigations to decide, whether they may be assigned significance as genus characters.

"This palm is called in Nicaragua 'Holillo' and is confined to the upper and lower delta formations of the river San Juan, where it without admixture of other trees forms large continuous forests. In the rainy season

the flat swampy regions where it grows are flooded, and one then sees only the crowns rise up above the water. I found it in flower at the beginning of March."

The extensive occurrence of the Nicaraguan palm naturally raises a question as to its assumed introduction from Africa and stimulates one to desire a new exploration of the region and the accumulation of ample evidences.

Not yet is there sufficient available evidence to enable the student to arrive at a judgment, on the one hand, on the different occurrences of Raphia in the Americas or, on the other hand, as to the relationships between these palms in the western and eastern hemispheres.

Following are leading systematic treatments of the genus Raphia:

Beauvois, Ambroise Marie François Joseph, Palisot de. Flore d'Oware et de Benin, i, 75-78 (1804).

Martius, Carl Friedrich Philipp von. Historia Naturalis Palmarum, iii, 216-217 (1838).

Mann, G. & H. Wendland. Transactions Linnean Society, xxiv, 437-439 (1864).

Drude, Oscar. Flora Brasiliensis, iii, pt. ii, 286-287 (1882).

Wright, C. H. Flora of Tropical Africa, viii, 104-107 (1902).

Beccari, Odoardi. L'Agricoltura Coloniale, iv, 137-170 (1910).

—— —— Webbia, iii, 37-130 (1910).

DeWildeman, Emile. Bulletin du Jardin Botanique de l'Etat a Bruxelles, vi, 144-146 (1916).

Manicaria

In the wide marshes back of Fort Sherman on the western side of Limon Bay, across from Colon, we had opportunity to see the monkey-cap or sleeve palm in an extensive stand, under the guidance of J. B. Shropshire, and to obtain good material with the aid of his men. It is an impressive experience to make one's intricate way in the dense forest of these palms amongst the crowded or leaning trunks with root-masses showing at the base, the great rustling dry leaves hanging from the crowns to the ground, and perhaps strands of aroids finding foothold on the boles. Trees were in all stages as we saw them in the wet woods of June and again of July, with the long flower-trusses bursting their pointed woven sleeves and the heavy big clusters of large tubercled walnut-like fruits pendent from the axils of the high-ascending petioles.

As in so many other cases of tropical palms, the name of this widespread kind is none too clearly determined. The genus *Manicaria* and the species *saccifera* begin in Joseph Gaertner's De Fructibus et Seminibus Plantarum, vol. ii, published in Tubingen in 1791. Gaertner's plant was accredited to Curaçao and "Guiana belgica" [Dutch Guiana], indicating that he had a coastal palm. He gives a good description of the spathe, spadix, and flowers of his *Manicaria saccifera* together with a full-page plate showing

these parts. The tree and foliage are not described, and he apparently did not have the nut for he writes "Fructus desideratur," and draws on Clusius who wrote nearly two centuries earlier. Long before Gaertner's time this palm had been known in Europe, probably from the curious dried spathe and the nuts, and had been described as *Palma saccifera*, "sack-bearing palm," in allusion to the pouch-like spathe or sheath.

FIG. 26. FRUITING HEAD OR CROWN of *Manicaria saccifera*.

This palm was published again in 1809 by Baron von Jacquin in his Fragmenta Botanica as *Pilophora testicularis*, from the farther West Indies and the northern coasts of South America. It is the one species *saccifera* that is supposed to grow on the islands and the coastal areas of the northern part of the continent. A form far inland, about Manaos, once called var. *mediterranea*, has recently been elevated to specific rank by Burret as *Manicaria Martiana*, and still later (1930) this author has described another species, *M. atricha*, from Amazonas.

The doubt as to the name of the coastal or island palm turns on whether there is one species or two, and what in the latter event may be the range of each. In Flora of the British West Indian Islands, 1864, Grisebach and Wendland make the island palm *Manicaria Plukenetii* on the basis of the picture in Plukenet's old Phytographia, 1691-2. Plukenet's figure shows a seed in its shell, the exocarp having disappeared; the leaf specimen available to Grisebach and Wendland was thought to differ specifically from those of *M. saccifera* figured by Martius. It is well known that many forms of leaves may be found in a single Manicaria forest or on trees of different ages. The other differences stated by Grisebach and Wendland are none too convincing. Until specimens are accurately collected from a wide range, it is better to treat *M. Plukenetii* as probably a synonym of *M. saccifera* and to restrict the genus as at

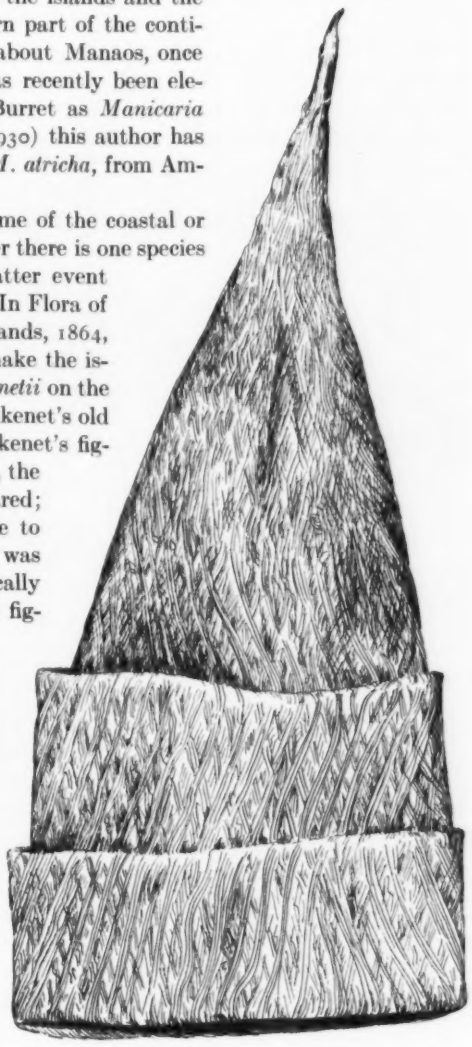

FIG. 27. BROWN CAP sold on the streets of Colon, spathe of *Manicaria saccifera* (×3/8).

present known to three species, two of which are upper Amazonian.

My own collection on Trinidad has fruits with smaller less pointed tubercles than those I obtained in Panama, but these differences may not be significant. Unfortunately Gaertner did not leave us a picture of the fruit of his *Manicaria saccifera*, but only of inflorescence with the sac-like sleeve, covering the flower-cluster, from which the Indians of Panama fashion the caps (Fig. 27) that are sold on the streets of Colon. The following description is drawn from my own collections at Fort Sherman.

Manicarias are monœcious unarmed palms, the staminate flowers being borne along the strands of the flower-branches and the few pistillate

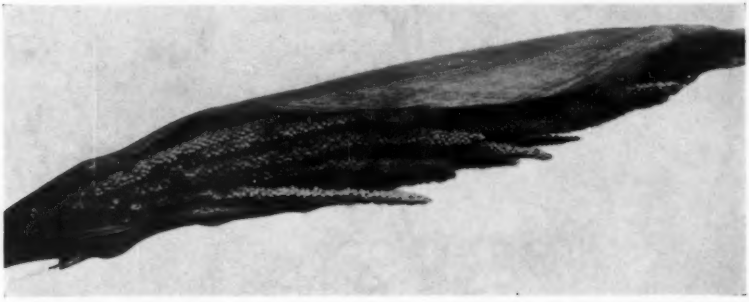

FIG. 28. SLEEVE OR SPATHE OF MANICARIA just ruptured, liberating the spadix. About 3 feet long.

FIG. 29. FLOWERS OF SLEEVE PALM, *Manicaria saccifera*. Pistillate above (× about 2); staminate below (×2½).

flowers at the base; inflorescence interfoliar; stamens many; pistillate flowers bearing as many as a dozen staminodia, and a single 3-celled ovary, one or two of the locules or cells often not developing so that the tubercled fruit may consist of a single ball or have two or three parts; seed large and single in each locule, the albumen continuous (not ruminate): leaves pinnately veined or parted.

Manicaria saccifera, Gaertn. Fruct. et Sem. Plant. ii, 468, t. 176 (1791). Figs. 26-31.

Pilophora testicularis, Jacq. Fragm. Bot. 32, t. 35 & 36 (1809).

Trunk erect but often leaning and sometimes inclined in lower part, to 30 feet tall and perhaps 1 foot diameter, prominently step-

ringed, enlarged and with a mass of roots at base, two trunks sometimes coalesced at bottom: leaves glabrous, to 30 feet long and 6 feet broad, variously irregularly cut to midrib or only part way down, some leaves with few separate pinnæ and others with many, sometimes the blade appearing nearly solid throughout but toothed and cut; segments often only 1 inch broad but commonly broader and usually nearly regular toward the base of the blade of leaves on bearing trees, the broader ones boldly toothed at apex to 1 or 2 inches with a very strong rib running to each apex and each sinus, terminal part of the leaf likely to be undivided or with broad segments and therefore presenting a strongly toothed appearance; petiole light and soft (not woody), to 4 feet and more long, smooth, keeled underneath and deeply channelled above; as the big leaves mature and die, they break over midway of the petiole and hang to the earth, making a weird old forest: in-

FIG. 30. PIECE OF FLORAL AXIS OF MANICARIA, three staminate flowers remaining (×2), bracts still intact.

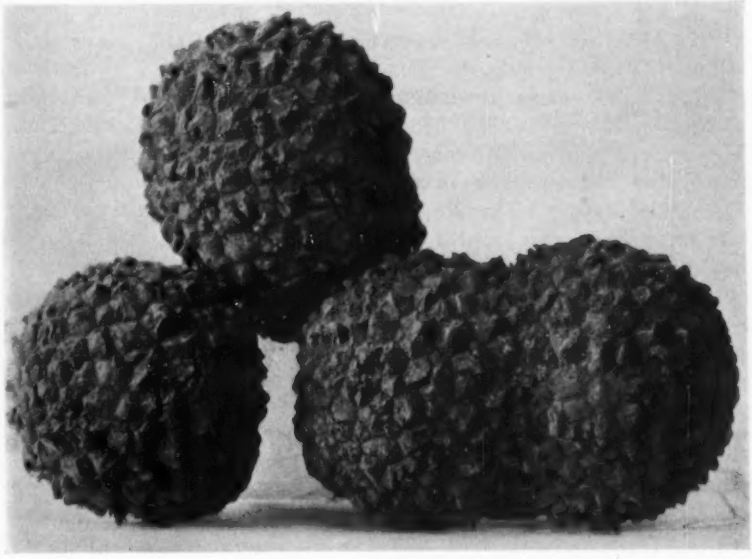

FIG. 31. FRUITS OR NUTS of *Manicaria saccifera*, natural size; one-carpelled and two-carpelled fruits.

florescence consisting of a simple axis with side branches inclosed in a narrow glabrous closed and indehiscent thin closely woven soft paper-brown pointed fabric or sleeve $2\frac{1}{2}$-$3\frac{1}{2}$ feet long which stretches in its mesh and tears irregularly at anthesis; flowering side-branches about 1 foot long, slender, bearing 1-3 large pistillate flowers in angles or curves at base and very many staminate flowers on the remainder subtended by narrow awl-pointed bracts; staminate flowers about 6-7 mm. long at expanding, the 3 broad calyx-parts at base about 1 mm., inner perianth of 3 oblong obtusish firm parts, anthers two dozen or more, versatile on slender filaments; pistillate flowers about 1 cm. long, oblong-conic, calyx-parts about 4 mm. long, 3 inner parts oblong and blunt-pointed, ovary obscurely obovoid, about 3 mm. long and exceeding the slender staminodia and surmounted by a conic 3-lobed style: fruit globular and about $1\frac{3}{4}$ inches diameter if simple (one locule developing), still bearing the old floral envelopes at the base, or a pair about 3 inches across the long way, all beset with pointed irregularly angled tubercles, earth-brown when dry.

Atlantic coastal areas of Central and South America and on some of the islands; distribution and geographical forms yet to be studied. This palm is not discussed by Barbosa Rodrigues in his great Sertum although listed there as Brazilian; its vernacular is given as Bussú, as also by Wallace in his Palm Trees of the Amazon; the name is written Ubussú by Huber in Arboretum Amazonicum, ii. t. 11 (1900).

ELÆIS: COROZO

The African oil palm received its first tenable name oddly enough in an account of American plants by Nicholas Joseph Jacquin, 1763 (Selectarum Stirpium Americanarum Historia, i, 280, ii, t. 172), the genus being founded on trees introduced into Martinique, "habitat in hortis Martinicæ rarius." The account reappeared in the 1780 edition of Jacquin (Select. Stirp. Amer. Hist. Picta) with the illustration enlarged and colored. The name Elæis is the Greek word for *oil*. This palm is now widespread in the American tropics as an introduced tree, sometimes spontaneous. The full name bestowed by Baron von Jacquin is *Elæis guineensis*, receiving its specific appellation from Guinea in Africa, where it is native. The generic name was later spelled Elais by Linnæus (Mantissa, i, 21, 1767). It is stated by Jacquin that the oil palm was known to the French as *Palmier*.

This tree is a well-known subject, the fruit and also the seed yielding palm oil of commerce. It has an erect rather slender simple trunk, ringed with the successive scars of fallen foliage. The crown is a canopy of long wide-spreading pinnate leaves; and in the axils, in the center of the crown, are borne the head-like flower-clusters, staminate and pistillate in separate heads. The nuts, less than two inches long, are surprisingly variable in size and shape.

In the same account, Jacquin records another similar palm in Martinique known as *Grigri*, with brief description and picture of the fruit; this is undoubtedly Acrocomia.

Jacquin also describes a palm growing in Cartagena (now Republic of Colombia) known there as *Corozo*, with a picture of the fruit showing calyx (t. 171, fig. 4); this is reproduced in Fig. 32. He states that the fruit yields oil and butter employed in domestic uses. This Colombian plant appears again in the posthumous Prælectiones of Linnæus, published in Hamburg in 1792; Giseke, the editor, accounts for the description and figure of Jacquin by erecting the genus Corozo; the name is starred to indicate (as explained in the preface) that it is a genus new since Linnæus. The word "caribæis" is associated with the generic name, but the nature of the occurrence as well as the form of the word itself show that it was not meant for a species-name.

FIG. 32. THE COROZO of Jacquin, 1763, early direct representation of the fruit of *Corozo oleifera*; shows the cupule or integument (right).

FIG. 33. NUTS OF OIL PALM, *Elæis guineensis*, about full size. Two at left drawn faithfully from specimens; one at right is Gaertner's figure of *Elæis melanococca* which is *E. guineensis*.

Before Giseke, however, a palm had been described by Joseph Gaertner in his notable work on the fruits and seeds of plants (De Fructibus et Seminibus Plantarum, 1788) as *Elæis melanococca*, with picture (vol. i, 18, t. 6, fig. 2) reproduced in Fig. 33, and this is the name since that time applied to the native oil-producing palm of tropical America. Durable fruits and seeds of plants were much figured in the early days inasmuch as they were easily transported and represented strange countries; often the source of them was little known or was even misunderstood. Gaertner figures and describes only the nut (without integuments) and the seed, and says nothing about the nativity of the objects or the uses; were it not for the fact that he compares the nut to that of *Elæis guineensis* and refers the plant to that genus we probably would never have applied the name to the American oil-bearing palm. The name *melanococca* signifies "black-berried," yet Gaertner does

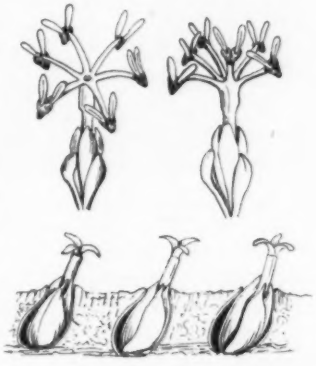

FIG. 34. FLOWERS OF GEONOMA (× 3). Staminate above removed from their cavities, pistillate beneath. *G. procumbens*, p. 75.

not describe the nut as externally black but as bearing fibers or striæ that are alternately coal-black, giving the object a marked variegated appearance: this may or may not apply to the nut of what we have known as *Elæis melanococca* in which the surface is black underneath the fibers.

FIG. 35. PISTILLATE SPIKES OF COROZO (left) AND OF ELÆIS. About natural size.

So little knowledge had Gaertner of his *Elæis melanococca* that he cites as synonym a figure in Caspar Bauhin's Historia Plantarum, 1650, representing what was supposed to be an East Indian nut with a mask-like (or face-like) look, "nux indica velut larvam ostendens"; the Bauhin picture looks little enough like the American palm we are considering; probably it represents *Elæis guineensis*. Unfortunately, Gaertner did not have the whole dried fruit so that the rather characteristic persistent calyx is not pictured or described.

What Gaertner had in hand on which to found *Elæis melanococca* was one of the many forms of *Elæis guineensis*, or African oil palm, itself. In any considerable collection of nuts of the oil palm one would find samples to match the Gaertner picture. I have a precise duplicate of it in my own herbarium, in size, shape, structure and markings; the external colors of such nuts are determined largely by age and conditions of storage: I have them ranging from sooty coal-black to tawny-brown. Without a range of specimens Gaertner would think his

sample to be quite different from the figure of Jacquin. This disposition of the case explains Gaertner's remark that *melanococca* is probably only a variety of *guineensis:* "præcedentis mera forsan varietas." *Elæis melanococca,* therefore, becomes a synonym of *E. guineensis.*

The American oil palm appears again in 1815 in the great work of Humboldt, Bonpland and Kunth as *Alfonsia oleifera,* accredited to New Grenada (Colombia). It is said to yield a liquid tallow (*sebum liquidum*) employed in lamps for sanctuarial and domestic purposes. The account in H.B.K. accords well enough with the American palm we are considering, and Martius makes a positive identification from material in the Willdenow herbarium.

FIG. 36. FRUIT HEAD OF AFRICAN OIL PALM (× nearly ½). *Elæis guineensis.*

Other names are associated with Elæis in the western hemisphere: *E. occidentalis* of Swartz in Floræ Indiæ Occidentalis, 1797, is *Calyptrogyne occidentalis,* a very different palm; *E. odora* of Traill in Journal of Botany, 1877, is *Barcella odora; E. pernambucana,* an old floating nomen of Loddiges, has no standing, nor has *E. montana* of Page, an old horticultural name in Jamaica. Any names that may have been applied to the true Elæis in Africa do not concern us here.

These two species of oil palm have been supposed to comprise the genus Elæis, *E. guineensis* in Africa, *E. melanococca* in America. The two palms

are very unlike in essential features, and it is strange indeed that they have been kept together in one genus all these years; apparently the standing of them and the nomenclature have been taken for granted, without new direct analyses.

Elæis and Raphia are the only palm genera with species native on both sides the Atlantic, but in no case is the same species accounted as natural in the eastern and western hemispheres. The case of Raphia cannot yet be adjusted, as explained under the treatment of that subject; but the Elæis situation may be appraised, even though collections in American are yet scant.

We have seen that as early as 1763 Corozo was recorded as the vernacular name of the American species, and Giseke in 1792 gave it technical botanical standing. I have seen the vernacular name *corozo* on specimens of the American palm collected in Colombia. Pittier in Enumeración de las Plantas Usuales de Venezuela calls it *corozo colorado*. In Panama I have heard it called also *corozal*. The African oil palm is sometimes listed as *Corozo* or *Corojo de Guinea*. The name *Corozo* or *Corojo* is applied in Cuba and Puerto Rico to Acrocomias, as also in Haiti in its form *corosse*. Apparently it was Acrocomia known to Mutis as *corozo* in Colombia to judge from his account published more than one hundred years after his death (in Gredilla, Biografía de José Celestino Mutis, Madrid, 1911): "Palma cuya caña cubre su contorno y de sus hojas, con agudas espinas negras de diversos tamaños" with fruit "del tamaño ó poco más del huevo de gallina." The name *corozo* has been employed also for the palm passing as Cohune and apparently for other Attaleas and Scheeleas.

Vernacular names of palms are likely to be loosely applied. Undoubtedly we must reserve Corozo as a class name for the American Elæis-like palm we are now discussing, in spite of the varied usage. The term oil palm should really be restricted to the African species, *Elæis guineensis*, so known uniformly in literature and commerce (*Palmier à huile*). The importance of this palm is attested by a coin of British West Africa, that carries the image of an oil palm tree.

Aside from the marked dissimilarities in stature and habit, there are strong technical differences between the African and American species; these differences are not brought out in recorded descriptions and illustrations. Both palms have flower-clusters interfoliar, close in the axils of the crown of the tree; staminate flowers immersed or imbedded and closely compacted in slender catkin-like fingers, stamens 6 with cohering filaments; pistillate flowers larger, on thick spikes that make a close durable heavy head; spathe or sheath of two parts or valves; ovary of 3 locules but not all developing; fruit an oblong or pyriform drupe-like body 1 inch or more long with a fleshy or at least soft sarcocarp yielding oil, and a hard nut with thick shell and continuous albumen and 3 pores at top. Beyond this

point, we come to pronounced contrasts between the two palms. Note the Figures 35, 36, 37, 38, 39.

The contrasts are striking, and also technically important. In the oil palm the fruiting head has a formidable porcupine look because of the strong long flat thorn subtending most of the flowers or fruits and particularly by the stout long flat prong terminating the branches or fingers (Figs. 35, 36); in Corozo (American) palm the fruiting head is marked only by a short prong terminating each finger, there being no subtending bracts (Figs. 35, 37). The oil palm nut at maturity comes nearly or quite clean out of its subtending floral parts and bracts, whereas that of the Corozo holds a definite fruiting calyx. In the oil palm the spathe is hard and breaks up into rigid parts, threads or fibers and at length practically disappears, leaving the cluster on a bracted peduncle or stalk; in the other the differently shaped spathe ruptures into soft tangled fibers or shreds and remains as a web or shag about the nearly sessile fruit-head or dead staminate cluster as seen in Fig. 37; in the oil palm the staminate fingers are closely pressed together in an erect ovoid compact body with a continuing medial axis with each finger ending in a spine, but in the corozo

FIG. 37. FRUIT HEAD OF COROZO (× nearly ½). *Corozo oleifera.*

they are loosely aggregated at the apex of the peduncle into an eventually declined or drooping cluster (as shown in the loose spent male cluster at the lower right in Fig. 37).

Staminate flower: in oil palm with filament-tube slender and stalk-like below and much broadened above, long anthers declined, pistillode very short or rudimentary perhaps with undeveloped prongs; in Corozo the tube columnar or only slightly widening upward, short anthers spreading, pistillode large and well developed with 3 marked stigmatic ridges. Pistillate flower: in oil palm about 20 mm. long (Fig. 38 right) sitting in a loose chartaceous or calyx-like cup not immersed in rachis and which is subtended by a stiff woody broad-based striate long-pointed bract (well shown by Gaertner in 1788), perianth parts long-oblong, the inner set (petals) somewhat narrower, ovary columnar and mostly curved and tapering toward base, about 15 mm. long, contracted to the style column; in Corozo (Fig. 39) projecting 5-7 mm. out of the heavy thick rachis with the other half imbedded, 6 perianth parts free and about equal but the interior 3 (petals) somewhat narrower, 8 or 9 mm. long and blunt, ovary about 4 mm. long and broad, without developing subtending bract.

Fig. 38. African oil palm, fruit (sitting in its husks or bracts, not mature) and nuts, *Elæis guineensis;* old pistillate flower and attachments (about × 1).

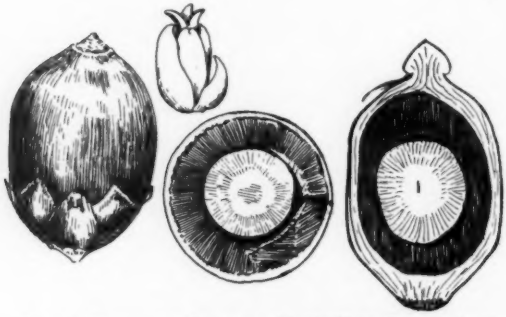

Fig. 39. Fruits of Corozo; old pistillate flower, about natural size, above. *Corozo oleifera.* Left hand specimen shows natural integument or cupule.

Fruit: in oil palm (Fig. 38) 1-1½ inches long, orange-red at maturity, oblong to mostly obpyriform, irregular and strongly angled, with fleshy-fibrous exterior or sarcocarp and a coarsely fiber-covered gray or brownish nut which is commonly misshapen and angular, truncate or obtuse at apex up to the beak and often tapering below, pores large and prominent, 2 locules often developing and style and stigmas long-persisting as a hard projection; in Corozo (Fig. 39) oblong-pointed, 1-1¼ inches long, deep or reddish-orange, smooth, finely striate lengthwise, pulp dryish and yellow and not oily to the feel, becoming a shapely stramineous fruit, nut hard and black, covered in straight fine not closely clinging fibers and the pores small, 1 locule developing fully, fruiting perianth 5-10 mm. long, the style and stigmas soon perishing; kernel short-oblong, regular.

All these dissimilarities impel me to consider the African and American palms as properly of two genera, nor have we far to seek for good names that may be separately applied:

Pistillate flowers sitting in a paleaceous cavity which is subtended by an elongated horn-like bract: fruit often 2-loculed, at maturity not retaining a perianth-cup, the integuments forming a long deep loose imbricated husk that mostly remains on the plant, the body irregular and misshapen, commonly contracted below and strongly angled, the pores large and becoming vacant, fibers of the covering closely adherent, kernel irregular because conforming to the locule: staminate cluster with rachis continuing greater part of its length: trunk tall and erect ..... ELÆIS
(not further treated in this article).

Pistillate flowers deeply immersed or sunken in the rachis, not subtended by a separate elongated bract: fruit 1-loculed, retaining the small definite floral cup or at least adherent to it, the body oblong and regular and little or not at all narrowed toward base, usually not angled, black, pores small and remaining plugged, fibrous covering not coarse and rough and mostly readily separating, kernel regular and attractive in shape: staminate cluster without long continuing axis: trunk prostrate for part or most its length, and rooting .... COROZO

COROZO, Giseke in Linnæus Prælectiones in Ordines Naturales, 42, 92 (1792)
Alfonsia, H.B.K. Nov. Gen. et Sp. i, 306, 245 in fol. ed. (1815).
Elæis in part Amer. auth.

†**Corozo oleifera,** n. tr. Corozo. Corozo Colorado. Corozal. Figs. 32, 35, 37, 39, 40.
Alfonsia oleifera, H.B.K. l.c. 307, 246 fol. ed.
Elæis melanococca, Auth., not Gaertner.

Trunk large, stout, usually creeping and log-like for several feet, either straight or curved as it lies on the ground, emitting roots, then with an ascending part high enough to hold the crown of leaves or sometimes 5 or 6 feet high (Fig. 40), the leaf-bases long persisting, dead leaves hanging in fragments: leaves outwardly curving or arching, glabrous; petiole to 5 feet

or more long with short thick spine-like teeth every inch or so on the two sharp edges, rounded underneath, flat to convex above, blade to 10 feet and more long, regularly and closely pinnate with 60 and more pinnæ, unarmed, pinnæ to 3 or 4 feet long at middle and 2 inches or more broad, with prominent rib and many other parallel veins or ribs, apex entire or obscurely short-notched: flowers and fruits already described.

FIG. 40. CHARACTERISTIC HABIT OF COROZO. *Corozo oleifera*. Old Panama.

The range of the corozo palm is from Central America to Colombia and the Amazon region, all one species so far as now known but this requires verification. There are indications that more than one species may be involved in the problem. I have not seen a fruit-head like that shown in Martius Hist. Nat. Palm. ii, t. 55 with the greatly elongated prongs; Martius does not state the source of this specimen, but he knew the plant only from northern South America and the Amazon region. This is the territory known also to Drude in Flora Brasiliensis. At present we can use only one binomial for these palms.

On Barro Colorado Island I saw it at several places along the shores although not reported in the printed lists. A tree of it, as well as of Scheelea, is shown in Jaques' photograph, Plate XIX in Bertha Bement Sturgis' book, Field Book of Birds of the Panama Canal Zone, 1928, illustrating the farther side of the first prominent point eastward from the Dock.

In the Fort Sherman swamps, Limon Bay, flowers of *Corozo oleifera* were the nidus of mites and little insects. The mites were of the genus Uropoda, as determined by H. E. Ewing of the National Museum, Washington, "found in association with insects, usually as symbionts." The insects, as identified by E. A. Chapin of the United States Bureau of Entomology, were beetles, *Mystrops mexicanus*, and *Smicrips* sp. "probably new"; also a species of Gelechiidæ, a small lepidopterous caterpillar, as determined by Carl Heinrich of the National Museum.

An interesting account of the Corozo palm is by Oersted in 1859 (Kjoeb. Vidensk. Meddel. 1858) where he described a var. *semicircularis* of *Elæis melanococca* with "trunk prostrate and semi-circularly curved and sends out numerous roots." He had apparently not seen the Panamanian or South American plant but thought his Costa Rican subject unlike the descriptions, so much so that "it may perhaps form an individual species." In view of the incomplete descriptions then (and now) available of the Corozo palm, the separation even as a variety cannot be accepted without actual comparison of plants. Of his var. *semicircularis*, he says (as translated from the Danish) that "it grows on the west side of Costa Rica at Palmar, where it forms an undergrowth of a mostly highly peculiar appearance. For the short, thick trunk is prostrate, semicircularly curved and sends out numerous roots, whereby it is fastened to the ground, so that it has much similarity to a large epigeous rootstock; only the top raises itself into the air, and the large crown of pinnate leaves, which spread themselves symmetrically to all sides, rests on the ground; between the thorny petioles shine forth the red-lead-colored fruits, collected into large heads. The fruits are used especially as food for poultry."

Seeman in his Flora of the Isthmus of Panama (1854) makes the following account of the Corozo: "The Palm is always found in swampy shady places, never on dry ground, or in sunny exposed positions. The trunk, which is short and thick, creeps along the ground, and has generally so very few roots, that it is not difficult to overturn a whole plant by a single kick of the foot. The leaves are 24 feet long; the fruit is red, hence the vernacular name 'Corozo colorado'. From it the inhabitants extract an oil, which they burn in their lamps. The fruit, after having been boiled, is stamped in a wooden mortar, until the sarcocarpium is separated from the putamen, and the oil is floating on the surface of the liquid mass thus produced."

The African and American oil palms are accounted monœcious. In Fig. 37 the dead staminate cluster may be seen below the fruiting-head. At

the Experiment Station, Mayaguez, Puerto Rico, I saw a small *Elæis guineensis*, standing alone, bearing only staminate spadices but T. B. McClelland informed me that in another year this tree had borne good fruit.

ACROCOMIA

On the Pacific side of the Canal Zone a spiny pinnate tree palm is native and it is frequently allowed to persist about premises and is sometimes planted (Fig. 41). There is confusion in the genus Acrocomia to which this palm belongs, but the Panama plant can hardly be referred to *Acrocomia sclerocarpa*, as has been the custom. The name *sclerocarpa* has gained wide currency in the American tropics, probably because of the accessible description and plates of Martius (Hist. Nat. Palm. ii, 66, tt. 56, 57, 100 fig. 5); it is a Brazilian species, not definitely recognized elsewhere. It is marked by the very spiny flower-sheath (spathe), spiny and sometimes swollen trunk and aculeate pinnæ.

The genus Acrocomia is American. It was established by Martius in 1824 (Hist. Nat. Palm. ii, 66). Upwards of two dozen binomials are in the genus, a number of them being *nomina nuda* of plants long ago listed in cultivation. Material in herbaria is fragmentary. Some of the names are represented by plants introduced to cultivation in the United States, but the identities have not been determined. The species were reduced to fifteen by Beccari in 1912 (Pomona College Journal of Economic Botany), in a list without descriptions, two being West Indian, one Mexican, one Nicaraguan, and the remainder South American.

Until the genus is monographed under one hand, it is impossible to name much of the imperfect material in collections. The native Panama species is apparently *Acrocomia vinifera*, Oersted in Kjoeb. Vidensk. Meddel. 47 (1858), of Nicaragua.

Acrocomia vinifera is characterized at length by Oersted, with which the Panama tree agrees in essential particulars. Apparently he did not have mature fruit, as he does not give sizes. He says the tree is 30 to 40 feet high, spiny, bearing bases of old leaf-sheaths. Not until the Nicaraguan palm is newly collected and studied can we make certain of the identity of the two.

As seen on the Pacific side of Panama the plant provisionally called *Acrocomia vinifera* is a straightly erect roughly ringed tree to 25 feet and more tall, with cylindric not swollen bole (Fig. 41), bearing a spreading thin crown of pinnate leaves, the older leaves hanging after dying unless removed by intent or by storm; inflorescence interfoliar, consisting of long slender cylindrical-tapering pubescent and only sparingly weakly aculeate spathes about 3 feet long, and an elongated glabrous spadix of a central axis and many short side branches that are staminate on 4 or 5 inches of the terminal part and that bear about 2 or 3 pistillate flowers below and have a sterile part or peduncle about 2 inches long: leaves bearing many

closely placed narrow pinnæ (Fig. 42) with strong midrib upstanding above and several fine side-veins, glabrous and shining above but grayish and finely pubescent and strigose underneath, the pinnæ about 2 feet long and 1 inch or less broad, spineless; petiole and rachis bearing sharp slender glabrous nearly black spines 2-4 inches long: staminate flowers densely packed in many rows

FIG. 41. CHARACTERISTIC TREE OF AN ACROCOMIA, supposed to be *A. vinifera*.

FIG. 42. PIECE OF LEAF OF THE ACROCOMIA (×¼).

FIG. 43. PISTILLATE FLOWER of *Acrocomia vinifera* (×2).

in pits on the rachis, about 8 mm. long at anthesis, 3 thick valvate petals connate at base, 3 sepals thin and about 2 mm. long, stamens 6 and about equalling corolla with large versatile anthers; pistillate flowers large (Fig. 43), about 13 or 14 mm. long, obscurely trigonous, sitting in a shallow rachis-cup, large pistil wrapped in the firm connate imbricate perianth parts, 3 prominent stigmas exserted: fruit (Fig. 44) depressed-globular, hard-shelled, smooth and shining, 1½ inches diameter, with 3-parted calyx-cup which is about ¾ inch across; nut single, thick and hard, containing a large angled seed with plain white albumen.

Another Acrocomia is at fruiting age in the Canal Zone Experiment Gardens at Summit. It bears a smaller fruit than the native species, does not so soon shed the leaf-bases from the trunk, and bears a rusty-tomentose spathe. Other species may be planted on the Canal Zone.

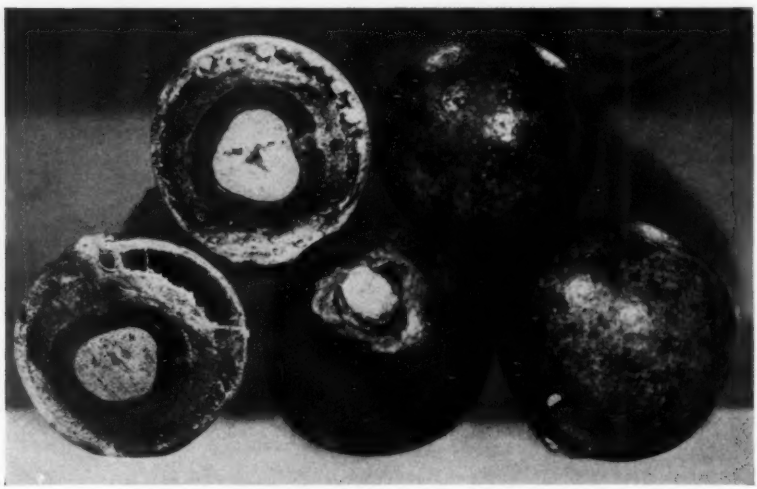

FIG. 44. FRUITS OF ACROCOMIA. About natural size.

SOCRATEA: IRIARTEA

In 1794 Ruiz and Pavon founded the genus Iriartea in their Floræ Peruvianæ et Chilensis Prodromus, p. 149 t. 32, and then made the species *I. deltoidea* from Peru. The name commemorates Sr. D. Bernardo de Yriarte. Whatever opinions may have arisen concerning the application

of the name do not concern us here except as to the identity of the Panama species. One species, supposed to be *I. exorrhiza*, is common on the Zone in forests; it is known as "jira," and also as "stilt palm" from its habit of

FIG. 45. ROOT-TRUNKS OF STILT PALM, *Socratea durissima*.

producing prominent brace roots. The foliage of these plants is quaquaversal, the pinnæ or segments being turned in all directions.

In 1856 Karsten divided the genus (Linnaea, xxviii, 263), taking out the species with many or indefinite stamens and subterminal stigma and other technical characters, as the genus Socratea. The new genus was accepted by Wendland in 1860 (Bonplandia, viii, 102-3), and by Hooker in

Bentham & Hooker, Genera Plantarum, iii, 875, 900 (1883), as well as later by Barbosa Rodrigues of Brazil. It was absorbed into Iriartea by Drude in Flora Brasiliensis and again in Die Natürlichen Pflanzenfamilien. The most recent study of the group is by Burret in Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem, x, 918 seq. (1930). Burret separates Socratea and admits five species, one of which (from Colombia) is new; a sixth species, *S. durissima*, is imperfectly known.

FIG. 46. LEAF OF STILT PALM, *Socratea durissima*, from a mature tree. Leaves on young trees may lack the extra ascending pinnæ or upper row. Leaf 6 feet long.

The Panama plant is a Socratea, and it is not any one of the five recognized species. It is either an undescribed species or the doubtful *S. durissima*.

The species *durissima* was made by Oersted as an Iriartea in 1859 from Nicaragua, and transferred to Socratea by Wendland. Oersted did not know the flowers or fruits, so that the species must remain in doubt until collected again from its original place, with complete material. Leaf specimens of the type are in the Universitetets botaniske Museum in Copenhagen, but in bad condition. Professor Carl Christensen has kindly supplied me with a photograph of the best specimen; the specimen appears to have been broken and shredded, probably under difficulties of transportation, but I can imagine that my own specimens of the Panaman palm would break up in about the same way under hard treatment. Oersted's informal account of the palm, as rendered from the Danish, is as follows: "This handsome palm is frequent in the primeval forest which is traversed by the

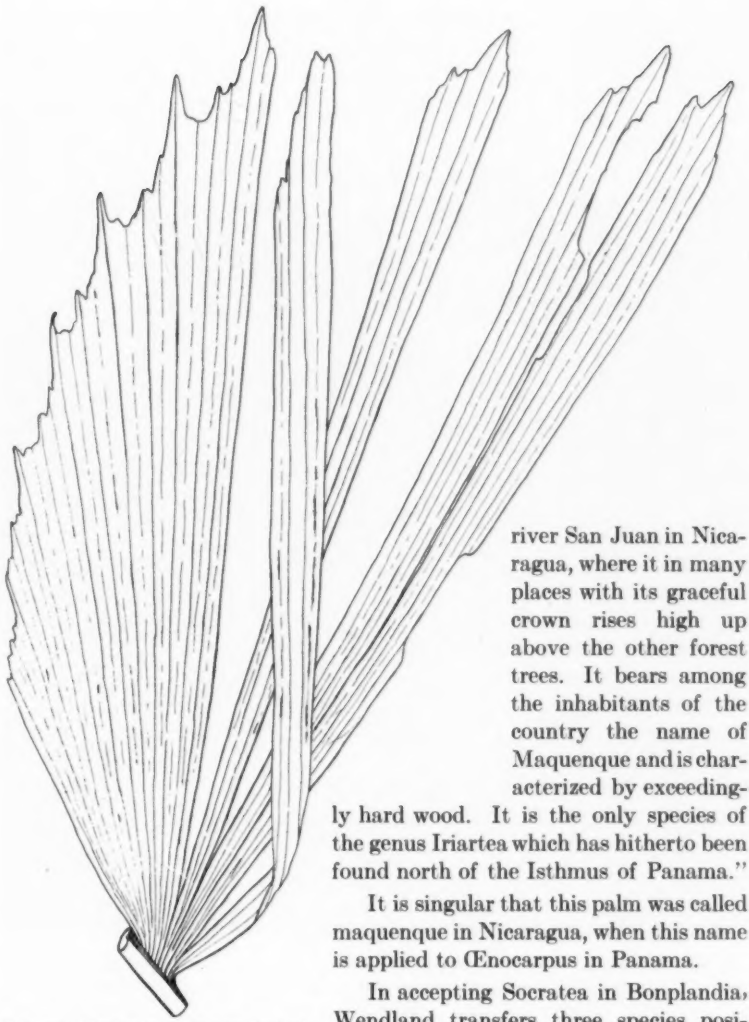

FIG. 47. PINNÆ CLUSTER on leaf of *Socratea durissima* (×¼).

river San Juan in Nicaragua, where it in many places with its graceful crown rises high up above the other forest trees. It bears among the inhabitants of the country the name of Maquenque and is characterized by exceedingly hard wood. It is the only species of the genus Iriartea which has hitherto been found north of the Isthmus of Panama."

It is singular that this palm was called maquenque in Nicaragua, when this name is applied to Œnocarpus in Panama.

In accepting Socratea in Bonplandia, Wendland transfers three species positively from Iriartea: *elegans*, *Orbignyana*, *exorrhiza*. A fourth species is the one in question, transferred to Socratea doubtfully: *S ? durissima*. *Iriartea*, Oerst. This doubtful transfer is considered sufficient by subsequent authors to establish the binomial *Socratea durissima*. Wendland had no additional information on the species itself.

The foregoing account of Oersted applies well enough to the stilt palm of Barro Colorado Island, shown in Fig. 45. The formal Latin diagnosis of Oersted is also a sufficiently good description of the Panaman plant except that the leaves as I saw and collected them were hardly glaucescent;

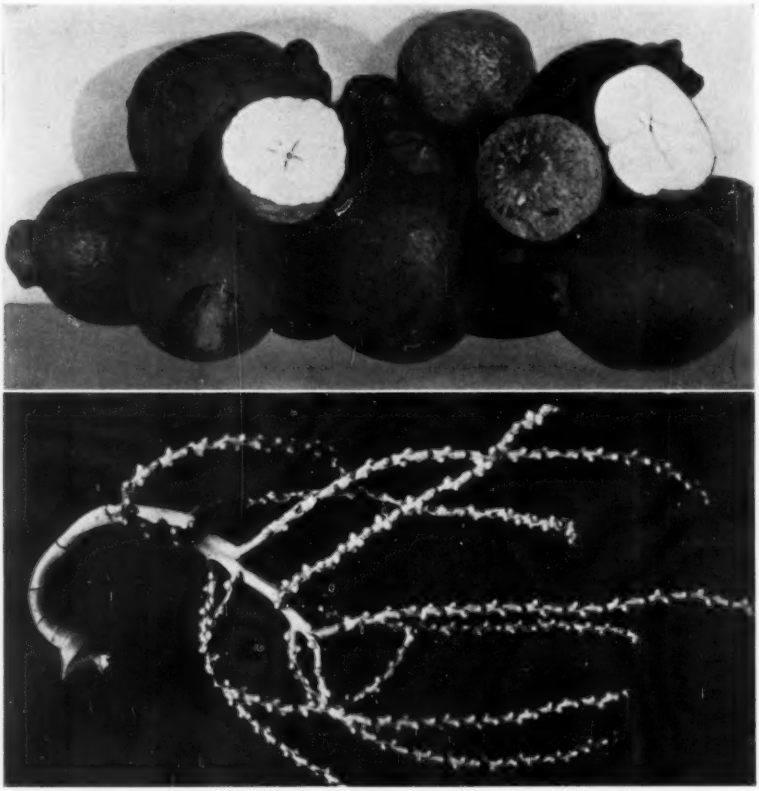

FIG. 48. SPADIX OF STILT PALM, *Socratea durissima*, normally pendent high on the bole of the tree; fruits of same, a little over-size, above, sent from Barro Colorado.

but Oersted apparently made the determination from dried material. He says the tree is 100 to 150 feet tall. One little point in his diagnosis decided me to call my plant *durissima*, at least until the Nicaraguan palm is restudied: he describes the base of the pinnæ as much contracted and fusco-tomentose; a small area of brown tomentum is at the base of each pinna or segment in my specimens from Barro Colorado.

The Socrateas are unarmed pinnate-leaved monœcious palms, pinnæ irregular or unequal, bloom infrafoliar, lower flowers on the branches of the cluster pistillate or sometimes the pistillate flowers borne throughout among the staminate; stamens many; fruit drupe-like, with thin or nearly dry epicarp, mostly 1-seeded.

FIG. 49. STAMINATE FLOWER AND STAMEN of *Socratea durissima* (×2).

Socratea durissima, Wendl. in Bonplandia, viii, 103 (1860). Figs. 45-49. (Provisional)

Iriartea durissima, Oersted in Kjoeb. Vidensk. Meddel., 1858, 30 (1859).

Iriartea exorrhiza, Auth., not Martius.

Slender very tall forest tree, reaching the top of the forest, to 80 feet or more often leaning or swaying, the trunk prominently ringed, producing many spiny-tubercled brace-roots that may become 10 feet high and the main trunk dwindling at the base (Fig. 45): leaves (Fig. 46) 5-6 feet long, wide-spreading, deep green, on mature trees bearing a dozen or more pairs of unsymmetrical pinnæ in each of two rows or series in different planes, the lower plane being about horizontal and the upper series somewhat ascending or upwardly flaring, one pinna often represented by 2-6 from an attachment as if it had split (Fig. 47), terminal lobe usually very broad and more or less undivided; pinnæ $1\frac{1}{4}$-2 feet long, firm, glabrous except for a patch of rusty tomentum on lower side at point of attachment, very strongly several- to many-ribbed, apices very broad (pinnæ variously cuneate) and truncate or irregularly oblique toothed or notched or shallow-lobed; petiole 1 foot or so long, slender, rounded underneath and grooved above; leaves on young trees simpler, with a single row of pinnæ on either side and which are broader and often long-jagged more than half way down the upper margin: spadix from a glabrous papery spathe of at least two parts, about 20 inches long, well beneath the crownshaft, the glabrous cluster simple with a central axis about 1 foot long and say ten side branches of similar length, the whole soon becoming pendent from the downward curve of the shank, some clusters bearing more pistillate flowers than others, none of the flowers sunken in the rachis; branches of spadix slender and hanging in anthesis (Fig. 48) but becoming stiff and more or less curled in fruit: staminate flowers (Fig. 49) large, about $\frac{1}{2}$ inch long, either scattered or compact on the rachis, soon deciduous, often angled by pressure; calyx small, 3-lobed and parts obtuse; petals broad-ovate and upstanding or incurved, acute, 10-12 mm. long; stamens about 35, nearly or quite equalling the petals, attached around a central disk, anthers linear and grooved on either side and less so on the edges, 5-8 mm. long, slender, filament less than 1 mm.; pistillate flowers scattered among the staminate, on some clusters few and widely separated and in others continuous throughout the length of the strand or branch, depressed-globular, small as compared with the staminates, floral envelopes 6 in two series, imbricated, broad and obtuse, pistil short and broad and obscurely trigonous: fruit (sent me later) a hard drupe-like body with thin brittle glabrous epicarp, oblong and obtuse but carrying a minute point which is borne at one side of apex due to the

abortion of two locules, 1-1¼ inches long including the short base representing the receptacle and indurated envelopes, about ¾ inch broad, dark green becoming dull brown (Fig. 48); seed single, oblong, loose in the integument but filling it, gray, albumen very hard and chalky white with small cavity or crack in center, plain (not ruminate).

Frequent in the forests of Barro Colorado Island, and elsewhere in the Canal Zone.

FIG. 50. COLONY OF ŒNOCARPUS, *Œ. panamanus*. The trunks are smooth and banded.

ŒNOCARPUS

The palm known as "maquenque" is common on Barro Colorado Island and elsewhere in the Canal Zone forests. It is tall and graceful, with several boles in a clump (Fig. 50), the younger trunks usually giving a leafy effect to the group. The main trunks become very tall, mounting high into the roof of the forest, with well-spaced bands about the boles, and a prominent black-green crownshaft at the summit. The hanging fruiting clusters (Fig. 52) have brilliant red strands, and bear profusely of black hard plum-like fruits.

This is undoubtedly the royal palm or *Oreodoxa regia* of Seeman and other early writers (see page 34). The *regia* itself is not known on the Isthmus except as an introduced planted tree.

This well-known palm is apparently without a botanical name. I gave it a tentative field-number nomen, and comparison abroad has now shown its distinctness from other species of the genus, its nearest ally probably being the recently described *Œnocarpus Huebneri*, Burret, from Brazil; I therefore confirm and publish the name.

† **Œnocarpus panamanus,** spec. nov. § Bacaba. Figs. 50-53.

Palma alta gregaria distincto culmine superiore, inflorescentia infrafoliaris: flores minimi, fere non longiores quam 5 mm.: apex nudus ramorum floriferorum 2-5 cm. longus, non filiformis: fructus breviovoideus 2-2½ cm. longus, 15-18 mm. latus, triplo longior quam cupula perianthii: ab *Œ. Huebneri* in apice comparate brevi ramorum floriferorum, ab *Œ. intermedio* fructu majore et perianthio fructifero, ab *Œ. multicauli* minoribus floribus staminatis differens.

Beautiful tall and slender unarmed monœcious palm to 70 feet and more, sometimes overtopping the surrounding vegetation, gregarious with few or several trunks in a cluster, the smooth boles 5-6 inches diameter at the base and bamboo-like with the rings far apart and not indented or notched; crownshaft high up, black-green, very smooth: leaves attractively long-pinnate, smooth and glabrous, 6 feet and more long, the regular narrow alternate closely placed pinnæ in a single row of about 60 either side the rachis; pinnæ long and narrow, 2-2½ feet long, ½-1½ inches broad, tip unequally bifid, strongly 2-3-ribbed either side the midrib and with intermediate parallel nerves; petiole 2-3 feet long, slender, terete with a narrow deep groove on upper side: spathe borne well below the crownshaft, consisting of single cylindrical curved tomentose sleeve 15 inches or more long that ruptures on one side, subtended at base by 2 keeled earlike more or less connate woody bracts about 9 inches long, serrated on the keel: spadix a simple axis 6-9 inches long from which depend numerous slender sinuous lash-like scurfy-pubescent strands 15-24 inches long and ⅛ inch thick (Fig. 51) that bear flowers in their curves and a naked tip 1 or 2 inches long: flowers many and very small, 3-5 mm. long, trinal, the central one pistillate and lateral two staminate, but at the base of the strand only the pistillate may be developed and toward the center and top only the staminate (and often irregularly) so that

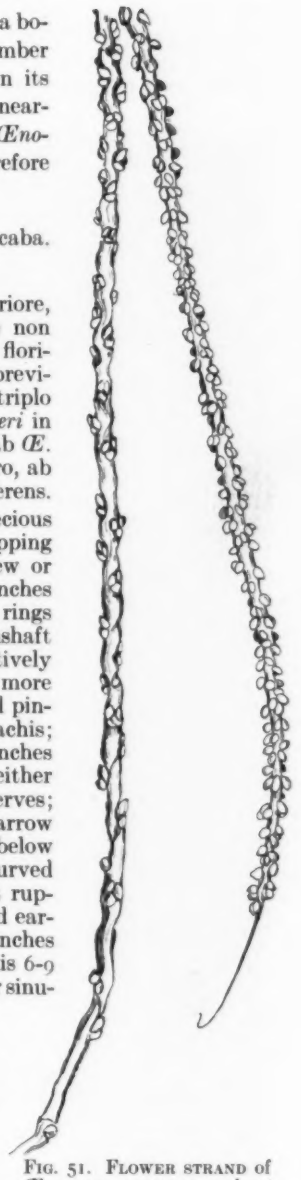

FIG. 51. FLOWER STRAND of *Œnocarpus panamanus*, about one-half full size.

the fruit is borne well toward the base or not beyond the middle of the hanging strings (Fig. 52); floral envelopes 6 in two series, stamens 6 with very short filaments and large versatile anthers: fruits usually a half dozen or less to a strand, short-ovoid to somewhat obovoid, $\frac{7}{8}$-1 inch long and

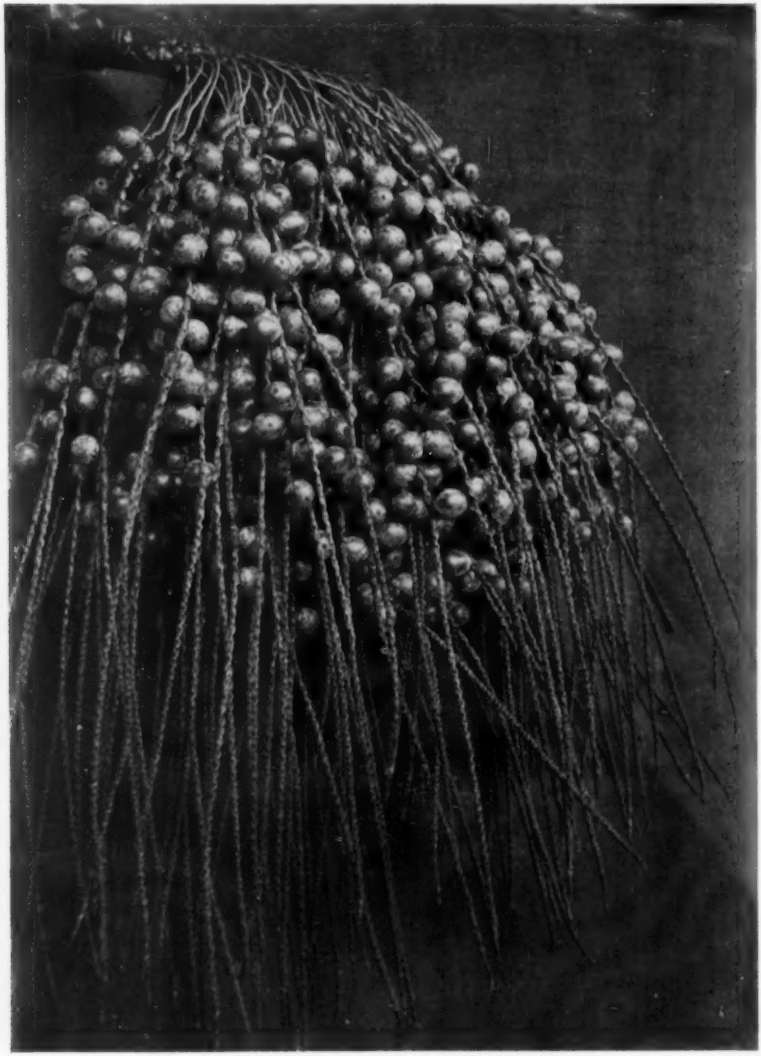

FIG. 52. FRUIT-CLUSTER of *Œnocarpus panamanus*.

$\frac{5}{8}$-$\frac{3}{4}$ inch broad (Fig. 53), hard, black, epicarp thin and dry, glabrous but slightly scabrous, point very short, the brown cup $\frac{1}{4}$-$\frac{1}{3}$ inch high and either remaining on the rachis or going with the fruit; nut single, equal to the integument, tightly inclosed in longitudinal fibers, albumen plain, white and hard with cavity in center.

The genus Œnocarpus (Greek, *wine-fruit*, from uses developed by the Indians) starts with Martius in his monumental Historia Naturalis Palmarum, 1823 (vol. ii, 21) with five species from equatorial Brazil. The latest treatment is by Burret in 1928 (Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem, x, 291 et seq.) who admits eleven species of Brazil, Peru, Bolivia, Venezuela, Colombia, three of them being new. *Œ. panamanus* belongs in Drude's section Bacaba, in which the leaves are spirally disposed in the crown, as usual in palms, rather than distichously, and to the group *Caudices cæspitosi* in which three species are heretofore recognized.

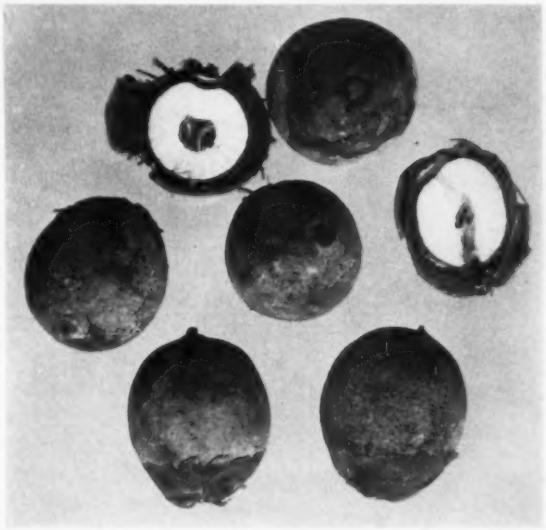

FIG. 53. FRUITS OF ŒNOCARPUS, natural size. *Œnocarpus panamanus.*

The Œnocarpuses are striking arboreous pinnate monœcious palms of strictly tropical regions. No technical account has heretofore been made of the occurrence of the genus in Panama or northward. The genus as now accepted is not homogeneous even though small in number of species. Much collecting and close field observation must yet be completed before the group is well understood or the limits of species clarified.

GEONOMA

Three Geonomas were taken on Barro Colorado Island. No other species were seen on the Canal Zone. These are small undergrowth woods palms, flowers unisexual. These three are Central American species, not

previously reported in Panama. Only the first of the three species has been figured before 1932.

Plant low, with trunk 6 feet or less, or often acaulescent: flower-cluster simple. (Continued on page 75)

FIG. 54. PISTILLATE PLANT, showing a single spike arising from the ground, of *Geonoma procumbens*.

Leaves regularly pinnate, of many narrow pinnæ ..... *G. procumbens*
Leaves often or mostly undivided, only irregularly splitting if at all ..... *G. decurrens*
Plant tree-like, with slender upright trunk to 15 feet: flower-cluster compound: leaves pinnate ..... *G. binervia*

Geonoma procumbens, Wendl. ex Spruce in Journ. Linn. Soc. xi, 105 (1871). § Eugeonoma, Spruce. *Calyptrogyne* of Barro Colorado list. Fig. 34 page 53, 54, 55.

As seen on Barro Colorado, this species usually presents itself as a stemless little palm (Fig. 54) but a short rough-ringed oblique or inclined trunk is obvious in some cases, the tallest caudex under observation being 6 feet high and about 3 inches thick: leaves arising from top of caudex, pinnate, petiole slender smooth and unarmed to 3 feet long, blade 3-4 feet long with about 24 pairs of pinnæ of which the terminal pair is very broad; pinnæ nearly regularly placed and opposite or subopposite, to 18 inches long and ¾-2 inches broad except the terminals which may be 4 inches, long-acuminate, lower side somewhat decurrent or slanting on rachis, ordinarily with 2 strong primary side nerves and intermediate secondary ones, terminals with perhaps twice the number of primaries: inflorescence axillary from the short caudex, of a single simple spike; peduncle and flowering part very slender, equalling the stand or curve of the leaves, the rat-tail spike itself to 18 inches long and to ½ inch thick (Fig. 55), rough from the closely placed flowers that protrude from their immersed matrices, the peduncle bearing 2 sheath-like spathes without foliaceous blades; sexes

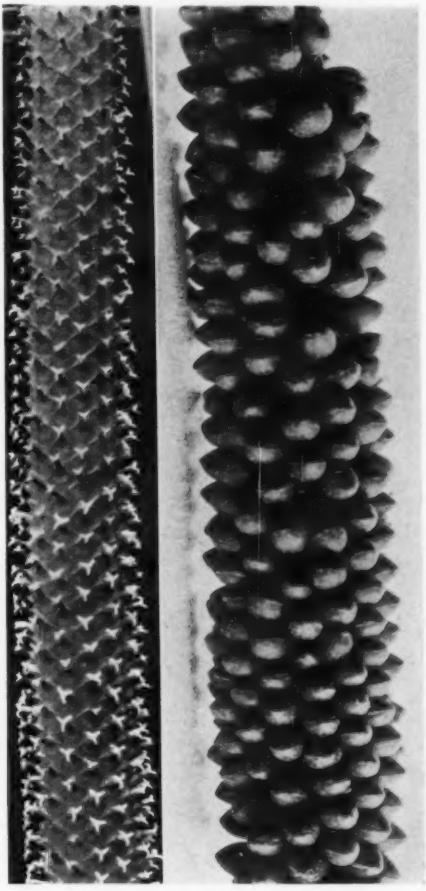

FIG. 55. PISTILLATE SPIKE, AND FRUITING SPIKE, more than natural size, of *Geonoma procumbens*.

on separate spikes, perhaps on different plants: staminate flowers whitish, about 7 mm. long, protruding from the spike prominently in anthesis, marked by the 6 stamens bearing 2 separated anther-cells like darts, the

FIG. 56. ENTIRE PLANT of *Geonoma decurrens*.

filaments united (Fig. 34); envelopes 6, an inner and outer series, the parts narrow-spatulate and tarnished at tip and somewhat more than one-half length of the staminal tube, the flowers quickly fugaceous: pistillate flowers in anthesis about 5 mm. long, the 3 white spreading stigmas conspicuously (Fig. 55) projecting beyond the matrices and the style sur-

rounded by a staminoidal tube; envelopes 6 in two series, the outer ones broader, all rusty-tipped; ovary minute, glabrous: fruits ovoid or elliptic, tapering both ways, about 9 mm. long, glabrous, closely packed endwise on the spike and appearing oblong-conic, greenish and rachis dull red; nutlet (Fig. 55) about 8 mm. long, glabrous, albumen continuous.

FIG. 57. STAMINATE SPIKE of *Geonoma decurrens*.

Ravines and damp woods. On Barro Colorado good examples occur along the creek at the beginning of Pearson trail near laboratory clearing and near beginning of Lutz trail; taken on Peña Blanco parcha, and elsewhere. *G. procumbens* is reported heretofore only from Costa Rica; first collected in 1857.

Geonoma decurrens, Wendl. ex Burret in Engl. Bot. Jahrb. lxiii, 162 (1930). § Eugeonoma, Spruce. *Asterogyne* of Barro Colorado list. Figs. 56-58. (F. M. Chapman, Natural History, 1932, fig. page 555).

Erect small palm with slender much-ringed trunk to 6 feet tall and 1½ inches thick (Fig. 56), bearing at its summit 8-10 pinnate-veined leaves deeply notched or fish-tailed at apex and mostly of a single piece but perhaps some leaves divided irregularly into several more or less indefinite narrow 1-several-nerved long-acuminate pinnæ, the divisions sometimes on only one side as seen at lower right in Fig. 56; leaves 4-5 feet long, 8-12 inches broad toward end, thin or papery in texture, furfuraceous on petiole and midrib and somewhat on main veins but otherwise glabrous, with many strong parallel veins 3-5 mm. apart, two apical lobes very long-pointed, base of blade decurrent-tapering to petiole which is 1½ feet or less long and much dilated at base: inflorescence axillary, of a single simple slender spike 12-15 inches long on a very slender flattened longer peduncle which is sheathed at base by one spathe, spikes curved and becoming drooping and nearly equalling the foliage in length, the unisexual little flowers imbedded

one at a place in different spikes on the same plant: staminate flowers (Fig. 57) in anthesis 7-8 mm. long, projecting about 5 mm. beyond the rachis, white; envelopes 6 in 2 series, narrow-spatulate, rusty-colored at tip, staminal tube projecting beyond them, the 6 exserted anthers on strong curving filaments, anthers separated by orange-colored connective making a dart-like point; pistillate flowers about 5 mm. long at anthesis, mostly exserted, envelopes 6, lanceolate-pointed, rusty-colored at top, the staminoidal tube and 3 curving stigmas projecting: fruit (Fig. 58) elliptic, pointed either end, 7-8 mm. long, light greenish-yellow, glabrous, finely striate, standing at right angles to rachis.

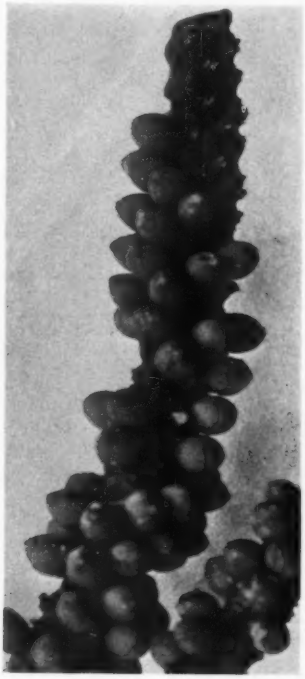

Fig. 58. Fruits of *Geonoma decurrens*. (×1)

Frequent in deep woods on Barro Colorado, forming colonies. Reported heretofore only from the northern part of Costa Rica.

Geonoma binervia, Oersted in Kjoeb. Vidensk. Meddel. 1858, 33 (1859).

§ Eugeonoma, Spruce. Figs. 59-61.

Tree, with straight woody hard gray or greenish trunk to 15 feet tall and 1½ inches thick, rings 2-3 inches apart, bearing a flattish spreading umbrella-like crown and branching drooping dull red inflorescences just underneath: leaves (Fig. 59) unevenly pinnate with about 25 pairs of pinnæ of which the pair at the apex is very broad, blade to 5 or 6 feet long, petiole 1-2 feet long, glossy, convex underneath and concave on upper face; pinnæ long-acuminate-pointed, attached obliquely on rachis, of many widths from less than ½ to 3 inches or terminals to 5 inches, papery and not stiff, glabrous or perhaps scurfy on main veins, the strong parallel nerves on veins 2-several or many: fruiting inflorescence provided at the base with a double upstanding ear-like grooved spathe (Fig. 60) becoming 6-7 inches long but which in its early stage in the head of the tree is flanked at either edge by two other similar spathes; cluster (Fig. 61) naked, dividing into several main branches bearing many hanging very slender close-hairy branchlets or spikes in which the minute flowers are imbedded, the two sexes in different clusters: staminate flowers about 4 mm. long, mostly exserted at anthesis, whitish; envelopes 6, oblong and nearly blunt, about as long as the staminal tube, filaments 6, rather stout and curved beyond the tube, the 2 separated anther-cells long and narrow and projected backward: pistillate flowers about 3 mm. long, and oblong-tapering 6

envelopes not quite equalling the staminoidal tube, stigmas 3, exserted and curving: fruit (Fig. 61 right) globular-oblong, 4-5 mm. long, very dark green but nearly or quite black when dried, glabrous, finely striate, nutlet 2 mm. long and globular, very hard, albumen continuous.

Scattered in woods on Barro Colorado, often obscured amongst the undergrowth. It is known in Guatemala, Nicaragua, Costa Rica.

FIG. 59. LEAF of *Goenoma binervia*. About 6 feet long.

The genus Geonoma begins with Willdenow in Memoires de l'Academie Royale des Sciences et Belles Lettres, Berlin, 1804, imprint 1807, pp. 37-39, where two species are described, *G. pinnatifrons* and G. *simplicifrons*, both from the Caracas region in Venezuela. It is exclusively an American genus and the most extensive in the western hemisphere, unless it is Bactris, being closely seconded otherwise only by Chamædorea. The latest monographer, Dr. M. Burret in Engler's Botanische Jahrbücher, 1930, admits 169 species, nearly 100 being new; others have been described subsequently. The species here described have been verified by him. The Geonomas range from Mexico to southern Brazil. They are small unarmed mostly shade-loving palms, with minute flowers sunken in the slim spikes of the simple or branched inflorescence, monœcious or dicœcious; fruits very small and seed-like, with even or continuous albumen. The stamens are united into a tube for part of their length, the free portion of the filaments

and the anthers with 2 separated locules being exserted. In the pistillate flowers the staminoidal tube is still present, and the genus divides itself into two groups or subgenera on the character of it: Eugeonoma, comprising the larger number of the species, having a cylindrical tube with truncate and very slightly if at all dentate apex; Astrandrœcium with a less evident tube deeply divided into 6 linear parts.

FIG. 60. EAR-LIKE SPATHES of *Geonoma binervia*. (×½)

CHAMÆDOREA

Of the extensive genus Chamædorea, with about 100 described species in Mexico, Central and South America, only one is reported from the Canal Zone and this is abundant on Barro Colorado.

Chamædorea is a Willdenovian genus, starting on page 40 of Memoires de l'Academie Royale des Sciences et Belles Lettres, 1804, printed 1807, with diagnosis and description of one species, *C. gracilis*, from Venezuela. This publication is antedated by Nunnezharia of Ruiz & Pavon, 1794, but the latter name is rejected by the International Rules. The genus has been divided into at least seven: Collinia, 1859, Eleutheropetalum (1854) 1859, Stachyophorbe, 1846, Dasystachys, Stephanostachys, Spathoscaphe, 1859, and Chamædorea proper. As the plants are diœcious and therefore not likely to be represented completely in herbaria or even in botanic gardens, a consecutive unified study of the genus is difficult. The segregation into genera is made on the evidences of technical floral morphology. If it is found that these critical differences are associated with habit and distribution it is probable that future workers will accept division into smaller genera.

Separation of these genera proceeds as follows by A. S. Oersted in Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjöbenhavn for 1858 (published 1859):

A. The inner perianth parts (petals) of the staminate flowers united at base with filaments and rudiment of ovary to form a stipe or base: anthers erect.

B. Aestivation (prefloration) of perianth of both sexes valvate.

FIG. 61. SPADIX OR FLOWER-CLUSTER, left, and fruit of *Geonoma binervia*; fruit about one-half full size.

FIG. 62. LEAF of *Chamædorea Wendlandiana*. About 7 feet long.

C. Inside perianth of both sexes gamopetalous and tridentate. ..... *Collinia*, Liebm.
CC. Inside perianth of pistillate flowers of 3 leaves (or petals). ..... *Eleutheropetalum*, Wendl.
BB. Aestivation of staminate flowers valvate, of pistillate flowers imbricate.
C. Berry 3-celled or -parted..... *Stachyophorbe*, Liebm.
CC. Berry 1-celled..... *Chamædorea*, Willd.
AA. The inside perianth parts of staminate flowers with stipe frequently wanting: anthers oblique and incumbent.
B. Stipe absent.
C. Inflorescence (spadix) of both sexes simple: pistillate flowers compressed-trigonous..... *Dasystachys*, Oerst.
CC. Inflorescence of both sexes branched: pistillate flowers depressed-globose..... *Stephanostachys*, Klotz.
BB. Stipe short: exterior parts (sepals) of staminate flower tubulose, interior obovate and usually plane..... *Spathoscaphe*, Oerst.

The flowers in Chamædorea are very small, in dense spikes or branches of the inflorescence; stamens 6, in a perianth of 6 parts in two series perhaps connate; stigmas 3, the perianth usually gamophyllous; fruit mostly 1-seeded, drupe-like.

The Panama Chamædorea is generally referred to *C. Wendlandiana* and this is probably correct although it is difficult to make out the six rows of staminate flowers specified by Oersted. The exact determination must await thorough monography of the genus.

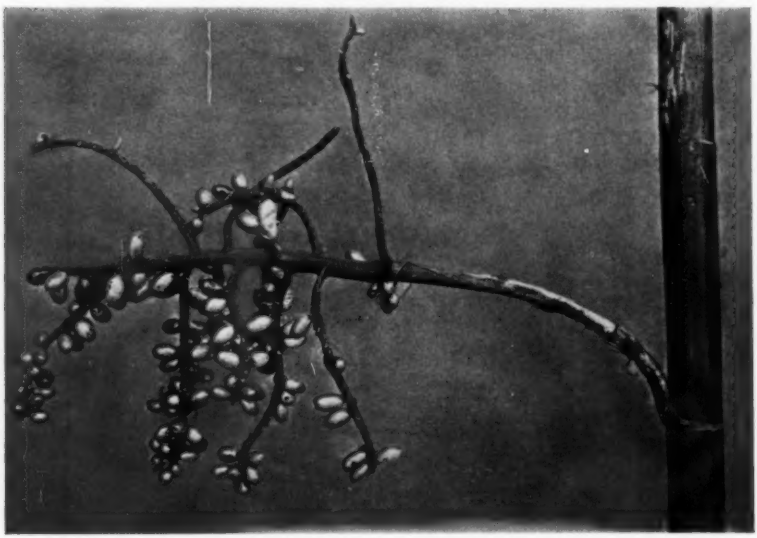

FIG. 63. FRUIT-CLUSTER of plant provisionally named *Chamædorea Wendlandiana*. (× about 1/6).

Chamædorea Wendlandiana, Hemsl. in Biol. Centr.-Amer.iii, 407 (1885). Figs. 62, 63. (Provisional)

Stephanostachys Wendlandiana, Oersted in Kjoeb. Vidensk. Meddel. 1858, 28 (1859).

Chamædorea Wendlandi, Wendl. in Kerchove, Les Palmiers, 240 (1878), *nomen subnudum.*

Tree to 12 or 15 feet with green smooth trunk to 2 inches thick, nodal rings 6-7 inches apart, erect or prostrate or inclined at base, producing prominent somewhat tuberculate brace-roots with forking ends from the lower joints and sometimes also from central parts of the stem: leaves (Fig. 62) from top of trunk, unevenly pinnate, blade to 6 or 7 feet or more long, with 15 to 20 well-spaced pinnæ on either side; pinnæ 24-30 inches long and 1-3 inches broad, long-pointed, glabrous, bright green, with several or many strong conspicuous parallel veins $\frac{1}{4}$ inch or more apart and that curve downward toward insertion on the rachis; petiole slender, 2 feet or more long, channelled or deeply grooved above: inflorescence at first erect, arising from successive nodes far below the leaves with 3 or more very short spathelets at or near base of peduncle that soon become frayed and a larger long-pointed one above that subtends the cluster at anthesis and about equals it, sexes on different plants; cluster 8-12 inches long composed of a simple axis and many slender side-branches or spikes 4-6 inches long and size of a quill densely covered with flowers, the staminate supposed to be in six rows; fruiting clusters with a somewhat fleshy orange-red rachis and similarly colored spikes and fruits, brilliant: fruit (Fig. 63) oblong-ellipsoid, to nearly or about $\frac{3}{4}$ inch long, glabrous and glossy, standing at right angles to rachis, exterior thinly fleshy, albumen white, continuous.

Woods palm, abundant on Barro Colorado in deep shade as single plants but frequently many of them at one location; conspicuous in fruit because of the orange-red berries and rachis of inflorescence.

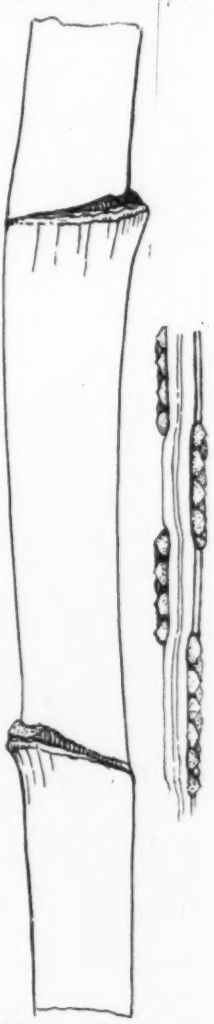

FIG. 64. TRUNK AND FLOWER STRAND of *Synechanthus Warscewiczianus* (×¾ and 4 respectively).

SYNECHANTHUS

From the large and perplexed genus Chamædorea Hermann Wendland in 1858 separated Synechanthus to include monœcious palms of this relationship with the minute flowers arranged in

lines of 6 to 10 along the angles of the spike, all but the lowermost being staminate; floral envelopes 6 in two series, joined at base, the inner ones valvate in bud in the staminate flower and convolute-imbricate in the pistillate; stamens 6; stigmas 3. Two species were established at the same time, *S. fibrosus* from eastern Guatemala and *S. Warscewiczianus* from eastern Costa Rica; in the following year Wendland separated *S. angustifolius* from Costa Rica. The first species, *S. fibrosus*, is taken over from Chamædorea under which it was well described by Wendland in 1854; *S. Warscewiczianus* is described only in respect to the shape of the leaflets (*laciniis late lanceolatis*), leaving much to be desired for accurate identification. *S. fibrosus* is illustrated in Botanical Magazine, t. 6572 (1858) and a flower detail of it is in Fig. 50, Engler & Prantl Die Natürlichen Pflanzenfamilien, ii, p. 3 (1889); otherwise the species appear not to have been figured. *S. fibrosus* was made the basis of the genus *Rathea* by Karsten, in the same year as Synechanthus was established.

Synechanthus Warscewiczianus, Wendl. in Bot. Zeit. xvi, 145 (1858). Figs. 64-66.

Reineckia triandra, Karsten in Koch & Fintelmann, Wochenschr. i, 349 (1858).

FIG. 65. TOP OF SYNECHANTHUS. Flower-cluster shows at the left. *Synechanthus Warscewiczianus.*

Collinia (?) *fibrosa*, Oersted in Kjoeb. Vidensk. Meddel. 1858, 5 (1859).

Slender small tree with green ringed erect trunk (Fig. 64) to 15 feet high and 1 inch thick, sometimes showing a few brace-roots at very base, with a good spread of long-curving irregularly pinnate leaves from near the top and erect slender broom-like inflorescences from nodes on the trunk: leaf-blades 3-4 feet long, bearing 8-10 drooping pinnæ either side the rachis but not strictly opposite, the pinnæ from ½ to 4 inches broad or the terminal ones still broader, long-acuminate-pointed, glabrous, with strong parallel nerves ¼-½ inch more or less apart; petiole to 2 feet long, slender, smooth, deeply channelled above: inflorescence to 3 feet long but sometimes half that length, at first a slim spike-like body with 5 or 6 sheaths of which the lowermost are 2-4 inches long and soon become frayed and the upper ones longer but without foliaceous blades; brush or inflorescence proper occupying about one-half the length of the whole, composed of very slender simple ascending sharp-angled glabrous branches that are more or less sinuous in detail; flower-lines (Fig. 64 right) about 4-5 mm. long alternate on the edges of the flattened fibrils of the inflores-

FIG. 66. SYNECHANTHUS IN FRUIT. (×⅝).

cence and 1-3 mm. apart, the 6-9 staminate flowers triangular and flat-topped before anthesis, pistillate flower circular in bud, all very small: fruit sparse in the cluster (which is still subtended by the uppermost spathes) because of the wide spacing of the pistillate flowers, standing nearly at right angles to axis, oblong, largest about $\frac{5}{8}$ inch (15 mm.) long and half as broad, smooth, light lemon-yellow to pale orange, drying black, albumen strongly intruded from the walls (Fig. 66).

Frequent as single specimens in woods on Barro Colorado Island; the inflorescences become dry and hang dead and inconspicuous.

Astrocaryum

Only one Astrocaryum is recorded on the Canal Zone, the so-called "black palm" from the color of the very hard wood. It is common on Barro Colorado, known as "chunga" or "chonta."

The Astrocaryums are pinnate-leaved tree palms with very spiny trunks and usually with sheaths, petioles and leaf-blades also spiny. They are American, allied to Bactris; about 60 specific names have been applied in the genus, but the group has not been monographed as a whole so that the systematology is yet indefinite. Many good plates are available, however, particularly in Martius and Barbosa Rodrigues. The latter in 1903 recognized thirty-one species in Brazil. The genus originates with G. F. W. Meyer in Primitiæ Floræ Essequeboensis, 265 (1818), with one species, *A. aculeatum;* the word astrocaryum (compounded from the Greek) means "star nut," but no further explanation is given by the author.

Astrocaryum is monœcious, both sexes being in each cluster or inflorescence, the few pistillate flowers near the base of the simple side-branches of the inflorescence and the many staminate occupying the ends. Inflorescence interfoliaceous, consisting of a stout simple axis and lateral fingers, the whole included at first in an elongated spathe; floral envelopes trimerous or irregular in two series (calyx and corolla), those of the staminate flowers free or connate, of the pistillate flowers joined in each series to form an urceolate or cupulate body; stamens usually 6; pistil single, morphologically 3-celled but two cells not developing. The fruit is a drupe-like globose ovoid or obovoid pointed body, sometimes prickly, with thin but mostly soft and fleshy outer pulp; nut very hard, with markings of 3 pores, containing a single variously marbled seed with plain albumen, hollow in center.

The Panama Astrocaryum has had no definite botanical appellation. In his Flora of Panama Canal Zone, Standley states that two species occur on the Atlantic slope, one of them probably *A. polystachyum*, Wendl., which was discovered first in Costa Rica. "The black palm of Panama is a

species of *Astrocaryum*, whose extremely hard, very black wood is utilized for making canes offered to the tourists. The wood has been suggested as suitable for the manufacture of handles for golf clubs and umbrellas."

The name *Astrocaryum polystachyum* appears not to have been published. It starts with the entry in Hemsley in Biologia Centrali-Americana, iii, 414 (1885) as follows:

"2. *A. polystachyum*, Wendl. ined.?

Costa Rica, on the Rio Sarapiqui (Wendland). Hb. Kew."

The Hb. Kew. specimen is before me as I write. It consists of one pinna and a piece of flower-cluster, both of which differ decidedly from corresponding parts of the palm of Barro Colorado Island and vicinity. The only way to validate the name *polystachyum* is to rediscover the plant in Costa Rica, obtain good material including mature fruits, and then to draw up a technical description publishing Wendland's name. In the meantime, the Barro Colorado palm may be described as new.

FIG. 67. TRUNK AND LONG-PEDUNCLED FRUIT-CLUSTER of *Astrocaryum Standleyanum*. Young plants of *Bactris coloniata* in bottom.

† **Astrocaryum Standleyanum,** spec. nov. § Acanthocarpæ, Barb. Rodr. Figs. 67-70.

Palma alta robusta erecta multis spinis complanatis 10-15 cm. longis, truncus late annularis: folia inæqualiter longipinnata, ad 4 m. circa, arcuata, petiolo spinoso et rachi; multæ pinnæ, aliquid aggregatæ, ad 1 m. longæ et 4-15 cm. latæ, glabræ vel laxe furfuraceæ, costa media valida, venæ prominentes, margines aciculares; spatha spinosissima; spadix 60-70 cm. longus, fragrans, ramuli 10-15 cm. longi, basi 1 vel 2 floribus pistillatis: fructus in spadice pendente angustoque, in pedunculo elongato spinosoque, drupaceus, obovoideus acuminatus, papillatus, aurantiacus, exterior aliquid carnosus, circa 4 cm. longus; nux lævis, radiate striata.

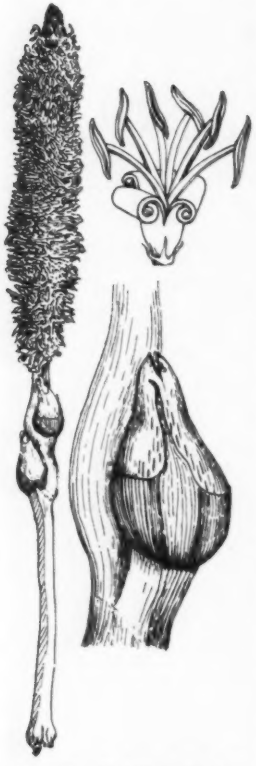

FIG. 68. FLOWER STRAND of *Astrocaryum Standleyanum*, somewhat more than one-half natural size, two pistillate flowers at base and remainder staminate; separate flowers × about 3, staminate above and pistillate beneath.

Trunk single (Fig. 67), to 40 feet and more, 5-8 inches diameter, wood hard, closely armed with deflexed flattened spines 4-6 inches long with annular spaces intervening, in exposed places bole becoming nearly bare: leaves pinnate, arching and drooping, 8-12 feet long, glossy on upper surface, making a broad close crown; pinnæ very many, irregularly disposed along the ridged and spiny rachis, more or less clustered, ½-1½ inches broad or on young plants not yet with mature foliage or fully separated leaflets some of them 6 inches broad, to 3 feet long, stiff-fish, glabrous or with loose scurf, with strong midrib ridged on upper surface and prominent lesser parallel nerves, the margins bearing small thin sharp upwardly pointing spicules; petiole 3-4 feet long, rather soft in texture, nearly terete above the expanded base, armed with backward-pointing spines of different lengths (from ½-6 inches and the large ones very flat): inflorescence fragrant, about 2 feet long at anthesis aside from peduncle, the long narrow densely black-spiny spathe soon becoming free of the flower-cluster which consists of a stout simple unarmed axis 1 inch or more thick from which issue irregular whorls of short branches 4-6 inches long (Fig. 68 left) with stem-like part at base then a zigzag part with 1 or 2 large pistillate flowers at the angles and topped with the long-cylindrical ends of closely packed cream-colored staminate flowers with prominent exserted anthers; staminate finger ¾ inch diameter in anthesis and perhaps 3 inches long, the flower with minute outer envelope (calyx), gamophyllous 3-parted inner envelope with revolute lobes and about 4 mm. long, the 6 stamens much projected, 3-pointed pistillode in center; pistillate flower about 1 cm. long, conic, with hyaline truncate basal cup 5 mm. long from

which awn-like scales may protrude, two spinescent folds representing outer and inner envelopes, and a lepidote tapering pistil with 3 large stigmas: fruits 1 or 2 to a lateral branchlet, the big cluster pendent on black-spiny peduncle sometimes 4 feet long; drupe somewhat obovoid, orange at maturity, $1\frac{1}{2}$-$1\frac{3}{4}$ inches long, abruptly pointed, papillate, with a soft but dryish thin pulp; nut ovoid, point downward (toward calyx), about $1\frac{1}{4}$ inches long, attractively marked with longitudinal black stripes and 3 foramen-spots with radiating lines; seed single, nearly filling the nut, with plain continuous albumen and a cavity in center.

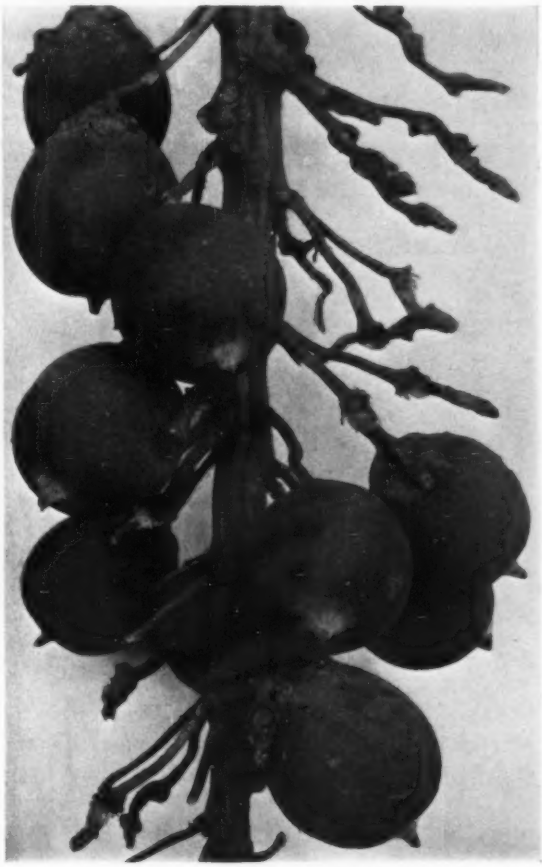

FIG. 69. PART OF A FRUITING BRANCH of *Astrocaryum Standleyanum*, nearly full size. Circular scars show where fruit has fallen, and club-shaped ends where staminate flowers were borne.

Common in woods on Barro Colorado and elsewhere in central Canal Zone; one of the conspicuous forest palms.

DESMONCUS

The American climbing palms known as Desmoncus are represented by about forty specific names, some of which are *nomina nuda* (without diagnosis and therefore not tenable). The genus dates from Martius, 1824, in Historia Naturalis Palmarum, ii, 84. The name was not explained by the author but it refers to the hooks (often representing leaflets) by means of which the plants climb. There is

no contemporaneous monograph of the genus. Most of the species are in Brazil, although the genus extends to Cuba.

Desmoncus is allied to Bactris and Astrocaryum, monœcious palms with unisexual flowers in interfoliaceous clusters in spiny spathes; staminate flowers on the upper part of the branchlets or fingers of the cluster, and the few pistillate ones at or near the base. The leaves are pinnate or pinnatisect, rachis usually spiny, and some of the leaflets represented by stiff sharp mostly recurved thorns. The fruit is a small more or less berry-like body with a single seed. The stems are often viciously spiny.

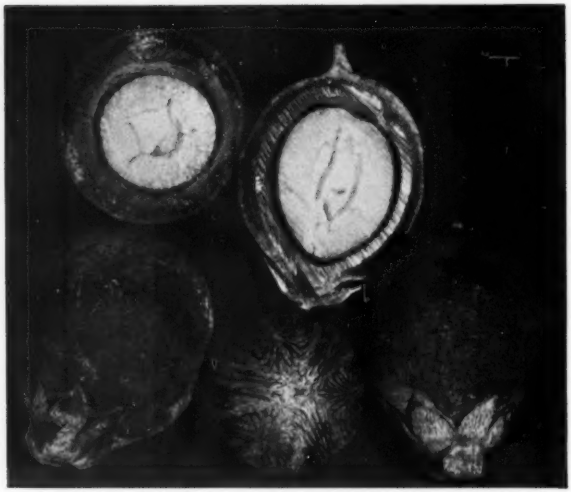

FIG. 70. FRUITS AND NUT of *Astrocaryum Standleyanum*. About full size.

Barbosa Rodrigues placed all the Desmoncus species in Atitara, a pre-Linnæan name, in 1902 (Contributions du Jardin Botanique de Rio de Janeiro, iii, 73) but abandoned this disposition in the Sertum the following year.

One Desmoncus is known in Panama, supposed to be *D. polyacanthos*, Martius. The genus is not reported in the Barro Colorado lists, but we found plants in a number of places there but always sterile. The plant is not *D. polyacanthos* but probably *D. chinantlensis*. The latter name starts with Liebmann in Oversigt over det Kongelige danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbeider, 1845, p. 8 (1846), in a list of palms from Mexico (Chinantlas). It is without description; but diagnosis is supplied by Liebmann in Martius, Historia Naturalis Palmarum, iii, 321 (1850). There are no illustrations of the species.

Very likely the Panama Desmoncus is *D. panamensis*, Linden in L'Illustration Horticole, xxviii, 16 (1881), a *nomen nudum* in a list of plants introduced by Linden, as also *D. grandifolius* and *D. Wallisi;* these names are therefore allowed to rest. It is not unlikely that the Desmoncus

on Barro Colorado is more than one species, but abundant flowering and fruiting material must be obtained to determine this point.

Type specimen of *D. chinantlensis*, Liebm., Mexico, in the herbarium at Copenhagen provides a good match for most of the material seen on Barro Colorado Island. We saw vigorous clambering canes or trunks 40 feet long, abundantly verdurous and vicious. One is soon snared and captured in a tangle of the lithe whips; stems spiny like a Bactris; leaves long-pinnate,

FIG. 71. LEAF OF DESMONCUS from Barro Colorado. (×⅓).

with mostly opposite or subopposite lanceolate to ovate-lanceolate thin not stiffly veined glabrous pinnæ 8 inches or less long, about four upper pairs on slender elongated rachis represented by thorns 1-1½ inches long, petiole and rachis also bearing spines. One of these leaves is shown, about one-third full size, in Fig. 71.

Type specimen of *D. chinantlensis* in Copenhagen, photograph of which is before me, is Liebmann No. 6595; it is the specimen to which reference is made in the preceding paragraph. In the National Herbarium at Washington are two Liebmann specimens under this name, Nos. 6594, 6596; they show different-looking very costate pinnæ and much smaller spines.

THE BACTRIDS

The plants known as Bactris are small gregarious or soboliferous usually viciously spiny pinnate palms, seldom tree-like, native from Mexico to southern South America, largely in moist or wet places and forests. The genus is greatly expanded in Brazil. Several of the species are native on the Canal Zone, but the natural history of them has not been worked out. Bactris, as ordinarily admitted, is probably a group rather than a genus.

The name and definition Bactris begin with Jacquin, 1763, in his notable Selectarum Stirpium Americanarum Historia, page 279, tabula 171. The citation is often erroneously stated in the literature. The genus in Jacquin is of two species, *Bactris minor* and *Bactris major*, both from Cartagena (Colombia); the figures are good for that period, showing tree and fruit of *minor* and fruit of *major*.

The earliest division of the group, separating Augustinea nearly one hundred years later (Karsten, Linnaea, xxviii, 395, 1856) but afterwards changed by its author to Pyrenoglyphis because of conflict, founds the new genus on *B. major* of Jacquin, citing the edition of about 1780; the smaller species, *minor*, remains the type of Bactris, and it is described on page 279 of the first edition of Jacquin whereas *major* is on page 280.; in the illuminated edition about 1780 the pages are 135 and 136 respectively. (Note the discussion of *minor* and *major* on page 100). O. F. Cook in 1901 proposed Curima for the Puerto Rican palm commonly known as Bactris (see page 113) and Barbosa Rodrigues in 1902 separated a genus Amylocarpus with many Brazilian species. Here rest the segregations.

There have been combinations of generic names. Thus as early as 1824 Martius had founded the genus Guilielma, but it was united to Bactris by Bentham & Hooker in Genera Plantarum, 1883. Hooker also reunited Augustinea with Bactris, and Barbosa is in agreement although he recognizes Guilielma. A related genus, Acanthococos, was established in 1900 by Barbosa for a single Paraguayan species, newly described.

My inclination has been to keep Pyrenoglyphis separate but I have not been able to make it work. The scalloped shallow duplicate cupule in

which the long comely fruit sits is indeed distinct in *P. major*, but in some of the related species it is not clear one way or another. The hand-like fruit-clusters of the *major* group are often distinct enough but I cannot follow that conformation through any number of species or correlate it with other characters. It will require much more and better material than is now in existence to clarify these morphologies.

The bactrids are monœcious palms with interfoliaceous inflorescence, small chartaceous spathes; spadices simple like an arum, or once-branched as in the pictures in this paper; flowers of the two sexes usually intermixed along the slender rachis and not sunken in the axis, with 3-parted calyx and corolla, the petals commonly much the larger, stamens 6-12, ovary short and broad and 3-loculed but fruit with a single seed, 3 pores or "eyes" prominent, albumen hard and homogeneous. The mature fruit is more or less plum-like, berry-like or turbinate in form, the exterior often somewhat succulent and in some species edible, nut closely covered with abundant fibers or other tissue; shape of fruit appears to be variable in the same species although good evidence on this point is mostly lacking; the fruiting perianth (cupule) is a characteristic feature although mostly not very large or deep.

The fruiting integument or cupule is composed of the more or less enlarged and indurated calyx and corolla, forming a double series. In the section Eubactris these parts are not conspicuously enlarged and are commonly entire or only crenate; the bottom ring is usually so inconspicuous as to be overlooked; the Eubactrids are mostly small palms with little and mostly small fruits. In the section Augustinea (Pyrenoglyphis), usually larger palms, the fruit is commonly longer than broad (mostly 1 inch or more long) and ovoid or oblong, the cupule being distinctly duplicate and margins scalloped (note Fig. 77, and lower right-hand fruit in Fig. 74); the upper empty part of the fruit shrinks in drying so that museum samples are often ovoid-acuminate (observe Fig. 77).

The Central American-Mexican bactrids are not numerous. Many undetermined specimens are in the collections. The species are:

Bactris acuminata, Liebm. Mexico.
baculifera, Karwinski. Mexico.
balanoidea, Wendl. Costa Rica.
fusca, Oersted. Costa Rica.
glandulosa, Oersted. Costa Rica or Nicaragua.
hondurensis, Standley. Honduras.
horrida, Oersted. Costa Rica or Nicaragua.
mexicana, Martius. Mexico.
Oerstediana, Traill. Costa Rica or Nicaragua.
(*B. bifida*, Oersted not Martius).
ovata, Wendl. Nicaragua.

Aside from these ten regularly published species are the following *nomina nuda*, all pertaining to Costa Rica except *subglobosa* which is Salvadorean:

Bactris caudata, Wendl. in Hemsl. Biol. Cent.-Amer. iii, 412 (1885).
longepetiolata, Wendl. l. c.
polystachya, Wendl. l. c.
subglobosa, Wendl. in Kerchove, Les Palmiers, 234 (1878).
villosa, Wendl. in Hemsl. l. c.

This is meager inventory for such extensive and productive territory. Thorough collecting in any part of the region should yield striking results.

On Barro Colorado Island the bactrids are the most abundant palms. Different species may grow together and not be distinguished even by the general botanist. We took eight kinds and others elsewhere, three of them sterile. Our findings assort themselves as follows:

A. Leaves gray-green and mostly dull, pinnæ closely and strongly parallel-ribbed or costate, margins markedly aculeate or setose, apex 2-lobed and one lobe commonly produced beyond the other (the other sometimes looking like a jog near the end of the leaf as if it had been cut).
  B. Surface of pinnæ plain between ribs or costæ, not prominently cross-veined.
    C. Pinnæ about the same width throughout most of their length, narrow (less than 1 inch in breadth), the terminal lobe usually not more than 1 inch long; rachis of leaf prominently rusty-tomentose.
      D. Width of pinnae (dry) for the most part ¾ inch, and pinnæ placed close together: fruit short- or globose-oblong to nearly globular. . . . . *B. Augustinea*, page 95.
      DD. Width of pinnæ ⅝ inch or less and pinnæ placed 1-2 inches apart so that the leaf has an open look: fruit oblong or acorn-like. . . . . *B. balanoidea*, page 97.
    CC. Pinnæ broad in middle (about 1½ inches) and narrowed either way, the terminal major lobe 2 inches or more long; rachis sparsely tomentose to glabrescent. . . . . *B. superior*, page 99.
  BB. Surface of pinnæ (dry) conspicuously cross-veined (reticulate or tessellate).
    C. Petiole armed only at or near the base, some of the spines very long and ascending.
      D. Rachis of leaf not armed; longest basal petiolar spines to 6 inches: trunk broadly ringed: fruit dark green, hairy. . . . . *B. barronis*, page 101.
      DD. Rachis somewhat short-armed; basal petiolar pines many and to 9 inches long. . . . . *B.* 529, page 103.
    CC. Petiole armed throughout with many short spines 1 inch or less to 1½ inches long: trunk little if at all ringed: fruit deep orange, smooth. . . . . *B. coloradonis*, page 104.
AA. Leaves bright green, usually glossy, pinnæ not closely rigidly costate (main secondary veins ½ inch or more apart), mostly rather abruptly caudate-acuminate, sides curving or not parallel for any distance, margins commonly only finely setulose.
  B. Petiole spine-bearing only at or toward base and rachis naked, spines fuscous-brown, or darker. . . . . *B. coloniata*, page 106.
  BB. Petiole and rachis spine-bearing throughout, the spines white or light-stramineous.
    C. Length of spines 1½ inches or more, very slender, terete or nearly so. . . . . *B.* 521, page 108.
    CC. Length of spines 1¼ inches or less, conspicuously flattened. . . . . *B.* 505, page 108.

† **Bactris Augustinea,** nom. nov. Figs. 72, 73.

Augustinea ovata, Oersted, Kjoeb. Vidensk. Meddel. 1858, 38 (1859); Sereno Watson in Proc. Amer. Acad. Arts & Sci. xxi, 466 (1886).

Bactris ovata, Wendl. in Kerchove, Les Palmiers, 234 (1878), not Stokes (1812).

Pyrenoglyphis ovata, Karsten, Fl. Columb. ii, 142 in obs. (1869).

FIG. 72. STIFF DENSE SPINY CLUMP of *Bactris Augustinea*.

Densely cespitose palm, making close small thickets (Fig. 72), strongly spinose; trunks to 10 feet high and 2 inches or more diameter, straightly erect, dark colored, clasped by the shredding leaf-sheaths; spines on trunk not numerous but abundant on petioles to the base and on rachis, some of them only ½ inch or even less long but many of them 2-3 inches, compressed, very sharp, black-brown: leaves regularly and continuously pinnate, 3-5 feet long, petiole and rachis conspicuously rusty-pubescent or tomentose; pinnæ regularly spaced and close together and sometimes 1 inch apart, 25 or more pairs, relatively short (12-18 inches), averaging about ¾ inch in width but some of them narrower, the larger number not exceeding 1 inch, glabrous above and puberulous underneath, grayish-green but lighter colored underneath, setose on margins, apex not elongated and usually with unequal points one of which may be an inch longer than the other, strong costæ 2-4 either side the rib and less distinct ones intervening, all closely parallel: spathe about 10 inches long, pubescent and acicular, narrow, pointed, contracted into a long unarmed portion; spadix with 8-10 branches 5-8 inches long from near the apex of the densely brown-setose peduncle, pistillate flowers along the middle: fruit (Fig. 73) cream-white becoming dull purple with a soft fibrous flesh, globular-oblong to slightly obovoid, 1¼-1⅜ inches long and 1-1⅛ inches thick, surface lightly pubescent and scabrous, apex rounded and with a central short point, cupule about ⅓ inch high with about 16 rather narrow but obtuse lobes in upper row; nut enveloped in a mealy rather than hair-like substance, 1 inch

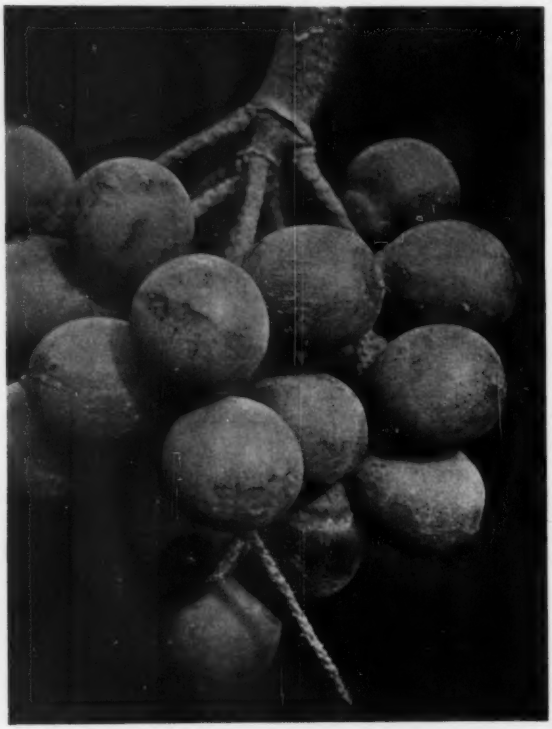

Fig. 73. Fruit-cluster of *Bactris Augustinea*. About three-fourths natural size.

or less long and $\frac{5}{8}$ inch broad, somewhat irregular, brownish, the three pores well down on the shoulders and with large depressions.

Near Summit, in low ground by the highway.

Type locality in Nicaragua. Photograph of type specimen in Copenhagen is very like my material. Distinction from *B. balanoidea* is in broader pinnæ more closely placed and in the different fruit (shown in Figs. 73, 74) and nuts. The differences in fruit are shown in Oersted's pictures in L'Amerique Centrale, t. 9, ff. 14-20, probably made from dried specimens; I have also examined Sereno Watson's material at the Gray Herbarium. Oersted contrasts this and *B. balanoidea* with *B. major;* but naturally the standing of all these species must await extended field study for it is doubtful whether the case can be determined satisfactorily from type specimens.

Bactris balanoidea, Wendl. in Kerchove, Les Palmiers, 233 (1878); Sereno Watson in Proc. Amer. Acad. Arts & Sci. xxi, 466 (1886). Fig. 74.

Augustinea balanoidea, Oersted, Kjoeb. Vidensk. Meddel. 1858, 39 (1859).

Pyrenoglyphis balanoidea, Karsten, Fl. Columb. ii, 142 in obs. (1869).

Slender palm making a large thicket, 15 feet tall; trunks 1-2 inches diameter, mostly not rigidly erect although upright, but sometimes leaning or crossing each other, thickly beset with spines at least in association with the shredding vaginate leaf-sheaths, old trunks becoming more or less bare: leaves evenly pinnate, 3-5 feet long, wide-spreading and mostly downwardly curved, old spent ones hanging; petiole very slender, 18-24 inches long and less than $\frac{1}{2}$ inch thick, narrowly channelled underneath and convex above, closely rusty-pubescent, armored with many dark brown very sharp spines 1-3 inches long, continuing as a pubescent and well-armed rachis; pinnæ 30-40 pairs, subopposite or the lower ones alternate, spaced 1-2 inches apart and this giving the leaf an open look, narrow ($\frac{1}{2}$-$\frac{5}{8}$ inch broad), 12-18 inches long, grayish-green and lighter colored underneath, glabrous or essentially so above and closely puberulent on under surface, margins setulose, apex unequally cut with one side lengthened into a slender point about 1 inch long, about 3 main costæ either side the midrib and finer veins between: spathe 12-15 inches long, thickly dark aculeate on a lighter colored surface, narrowed into a black densely setose portion; spadix with 10 or 12 simple short branches arising near top of peduncle, the latter becoming elongated and flattened and hanging in fruit, pistillate flowers borne about midway of the strands: fruit (Fig. 74) cream-colored (becoming purple?), oblong-balanoid (acorn-like), $1\frac{1}{2}$ inches long and 1 inch broad, sides parallel most of the way or sometimes widened toward the top, rounded at apex and beak short or negligible, surface scabrous, cupule about $\frac{1}{3}$ inch high with 12-14 short obtuse lobes in upper row; nut much enveloped in hair-like fiber, about $1\frac{1}{4}$ inches long and half as broad, somewhat irregular, black, with one pore on the shoulder near the

apex and the other two lower down on the other side; peduncle elongating, flattened.

Fort Sherman, Bay of Limon; a sterile clump on a low grassy cape beyond Fairchild Point on Barro Colorado Island (accessible in June with a cayuca) 8 or 9 feet high, with very spiny trunks, is probably the same.

Fig. 74. The attractive fruits of *Bactris balanoidea;* at right, nearly full size.

Type station of *Bactris balanoidea* is on the west side of Costa Rica; also in Guatemala; probably a widespread species.

In founding *Augustinea balanoidea* Oersted did not have leaves. He described the fruit, partly by comparison with that of *A.* (*Bactris*) *major*, and figured it as well as spadix and floral parts in his L'Amerique Centrale (1863), t. 9, ff. 1-13. The fruit character corresponds well with that of the

Fort Sherman plant here discussed, and the leaves are now apparently first described in detail although Sereno Watson gave a brief characterization of them in 1886; even so, the species is yet none too clear.

† **Bactris superior,** spec. nov. § Augustinea. Figs. 75, 76, 83 left.

Palma gracillima, ad 15 m. vel ultra alta, in sparsis coloniis: a *B. balanoidea* non conferta aggregatione differens truncis altioribus, petiolo multis spinis non modo parvis sed etiam longis, spinis minus compressis, pinnis minus crebre dispositis et multo latioribus (ad 4 cm.), apice longo et tenui-acuminato, rachi folii proxime vel tote glabra, fructu ovoideo-conoideo.

FIG. 75. SUBTERRANEAN BUDS on crowns of *Bactris superior.*

Attractive tall palm, in loose open not extensive colonies and sometimes seen as single tall slender trunks, to 50 feet or more tall, the trunks often leaning and upwardly bent, to nearly or quite 2 inches diameter, wood hard, with wide smooth annuli or blank spaces, spines blackish and only indistinctly compressed, to 2 inches long, on upper part of trunk and on leaf-sheaths ascending or horizontal and on lower part declined: leaves 4-6 feet or more long, evenly and continuously pinnate, of 30-40 pairs; petiole deeply channelled above, somewhat scurfy-pubescent, closely beset with light colored spines 1 inch or less long and a few others to 2 or 3 inches, the stout rachis broader than high, with strong ridges and upper part of it not noticeably pubescent or even glabrescent, bearing brownish or stramineous spines throughout; pinnæ widely spaced (1-2 inches apart), main ones 16-24 inches long and 1½ inches broad at middle, one of the points narrowly produced to 2 or 5 inches, deep green but mostly dull, indifferently lighter colored underneath, glabrous, tapering toward base and prominently so to apex, margins setulose, about 2 main costæ either side of rib and approximately ¼ inch apart, with thinner veins between: spathe 12-16 inches long, pubescent, shaggy with blackish spines, not aculeate within, the shank unarmed and pubescent; spadix with 10-18 strands from 5-10 inches long attached near top of flattened eventually curving shank or peduncle which is hardly setose, pistillate flowers mostly nearly the entire length: fruit (Fig. 76) purple at maturity, somewhat fleshy, lightly scabrous,

1½ to nearly or quite 2 inches long and about 1 inch thick, oblong-turbinate to-obovoid, broad at top but attenuate when dry, with a rather prominent point or tip, cupule prominent and about ⅛ inch high, with about 16 conspicuous lobes in the upper row; nut contained in brittle not hair-like fiber (when dry), about 1¼ inches long, slightly irregular, the three pores on upper third with one a little higher than the others.

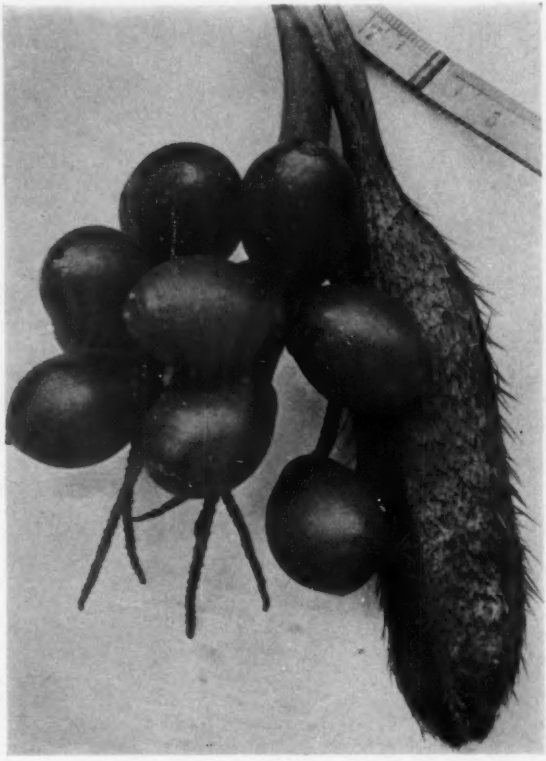

FIG. 76. FRUITING CLUSTER of *Bactris superior* (×½). Point is broken from the spathe in this specimen.

Barro Colorado Island, called "caña brava." A colony stands not far from the entrance to Snyder-Molino trail in front of the prone great trunk under which one walks and where bats hang by day, and is abundant on the farther part of the Miller trail, and was seen elsewhere.

I hesitate to describe this prominent palm as a new species but I do not know what else to do with it. Generally it has been supposed to be *Bactris* (or *Pyrenoglyphis*) *major*, but when one analyzes that historic species this disposition becomes doubtful or untenable. Confusion would be increased rather than diminished by referring the plant to *major* at present.

We have noted (page 92) the beginning of *Bactris major* in Jacquin. He states that *major* is similar in habit to *minor* which he describes and figures. We are none too certain of the plant intended as *minor* and the other is still more in doubt. Jacquin mentions the multicrenate cupule of

major formed by the calyx and corolla, the drupe being size and shape of a hen's egg, and figures fruit, nut and kernel, reproduced in Fig. 77. The picture was undoubtedly made from a dried specimen. Karsten in Floræ Columbiæ gives us a full characterization of the plant he considers to be *major* (as *Pyrenoglyphis major*); he takes pains to figure both fresh and dried fruit; he displays a clump of the plant with several low growths and two tall trunks of which one is conspicuously curved or flexuose, quite unlike what one sees in the plants I know as *B. Augustinea* and *B. balanoidea;* how well the picture represents the natural habit, in the days before field photography, we do not know. New studies on the ground in the neighborhood of Cartagena and other parts of northern South America are necessary before we can clarify the two species of Jacquin; and until that time it is futile to speculate on the distribution of them. Karsten's *major* has obovate leaves, much narrower linear-lanceolate pinnæ than the plant I describe as *B. superior*, petiole and sheath white-tomentose, different spathe that is two-keeled, setose peduncle, narrower fruit, and other divergencies. All the specimens I have seen, reliably accounted to be the South American *B. major*, have narrow closely costate pinnæ with parallel and conspicuously setose margins, set close together, very unlike the pinnæ of *B. superior*.

FIG. 77. ORIGINAL PICTURE of *Bactris major*. Jacquin, 1763, repeated in his edition of about 1780.

† **Bactris barronis,** spec. nov. § Eubactris. Figs. 78-80.

Palma humilis in cæspitibus parvis solitariisque: trunci 2-2½ m. alti, 5 cm. vel minus in diam., spinis atris 2-3 cm. longis: folia æqualiter pinnata, pinnæ in 30 vel pluribus jugis; pinnæ 40-60 cm. longæ, 2-4 cm. latæ, cinereo-virides, glabræ, aciculares in marginibus, valde venatæ, tenuiter reticulatæ, rachis espinosa, petiolus spinosus basi tantum, spatha sessilis, 15-30 cm. longa, pendens, atro-aculeata: fructus in spadice spisso breviique, durus, atro-virens, hirsutus, 10-12 cm. in diam.

Small palm in close clusters of a few trunks or sometimes only two or three (Fig. 78); trunks erect, to 8 feet high and 2 inches thick, prominently annulate with zones of upright or spreading black spines ½-1½ inches long beneath each ring: leaves mostly continuously pinnate but sometimes interrupted; petioles 3-4 feet long and strongly ascending, slender, deeply canaliculate on upper surface and convex on lower face, glabrous, lower

FIG. 78. CONTRAST IN BACTRIDS. At left, a close stand of *Bactris barronis*. Right and center, open diffuse colony or patch of *Bactris coloniata*, the trunks widely spaced. Barro Colorado Island.

foot or so bearing many black spines ½-2 inches long and a few upright ones to 5 or 6 inches long, remainder of petiole and the rachis unarmed; pinnæ 30 or more, opposite or subopposite pairs widely spaced (1-2 inches apart or to 3 or 4 inches on lower part of leaf), 2-2½ feet or more long and 1-1⅝ inches broad, gray-green, with 2 or 3 very strong costæ either side midrib and smaller prominent parallel veins between, glabrous, conspicuously cross-veined with short lines or wrinkles, margins nearly parallel for much of their length and setose on upper half, narrowed toward apex and then one apical lobe prolonged 2-4 inches, terminal pinnæ usually not long-pointed: spathe 6-12 inches long, broad, practically sessile, rather soft, densely black-aculeate, soon hanging, borne in axils of very long ascending tight petioles and therefore appearing to be borne on the trunk below the leaves or in fruiting stage the petiole perhaps fallen (Fig. 79); spadix a dense cluster, yielding a compact ball of fruit (Fig. 80) nearly as broad as long, on a short gooseneck peduncle: fruit ⅜ to about ½ inch broad, flattened on top and somewhat tapering below and thereby broadly turbinate and with only a little cusp at apex, dark green, hard, densely short-bristly hairy (hairs of *B. acanthocarpa* of Martius are sparse and long), shell thin; nut about ⅜ inch either way, flattened on top and somewhat narrowed below, three large pores near upper rim and two of them rather near each other.

Woods, Barro Colorado Island, on Snyder-Molino, Lutz, James Zetek trails, and elsewhere; apparently not one of the abundant bactrids.

FIG. 79. SPATHE AND CLUSTER of *Bactris barronis*.

Bactris no. 529.

Dense full-foliaged attractive low sterile clump on edge of clearing at Redwood House, Barro Colorado Island; basal petiolar spines many and to 8 or 9 inches long, rachis of leaf also sparsely armed. Perhaps a juvenile state of *B. barronis*.

† **Bactris coloradonis,** spec. nov. § Eubactris. Fig. 81.

Trunci rari, graciles ad 8 m. alti et 4 cm. in diam., non definite annulati, spinæ atræ, tenues, 3-5 cm. longæ: folia inæqualiter pinnata, pinnæ in 25-30 jugis; pinnæ 60-70 cm. longæ, 3-5 cm. latæ, valde multicostatæ, valde reticulatæ, cinereo-virides, glabræ, margines leviter aciculares vel denticulatæ, rachis espinosa, petiolus spinis multis atrisque; spatha 20-28 cm. longa, divaricata, spisse aculeata, angustata, ad manubrium breve: fructus in spadicibus densis, brevibus, pendentibus, obovoideus, glaber, peraurantiacus, fere 2 cm. longus, obtusus.

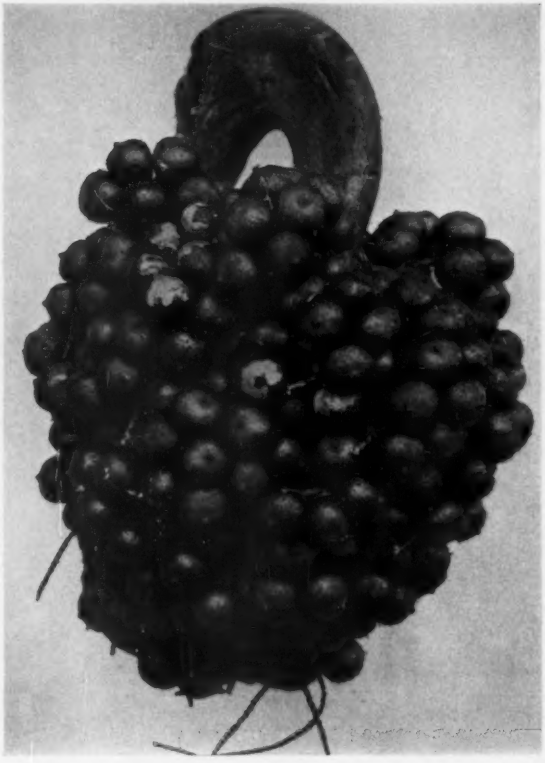

FIG. 80. FRUIT-CLUSTER of *Bactris barronis*, a green and hairy-fruited species. About thee-fourths natural size.

Tall and slender bactrid, to 25 feet or more, usually seen as single or spaced trunks but perhaps several in a locality, 1½ inches thick, without definite rings or bands, bearing scattered slender brownish or black spreading spines ½-2 inches long: leaves broad for their length, to 8 feet or more long, irregularly pinnate, some of the pinnæ being clustered and those at base widely separated and at top of leaf close together; petiole long, expanded at base and deeply channelled above, convex on under side, closely pubescent and the unarmed rachis glabrate toward top, spines many and slender and of many lengths but usually not exceeding 1½ inches; pinnæ 25 or more pairs, lower ones often with a few spines on the lower face toward the base, 2-3 feet long and 1½-2 inches broad at middle, glabrous, with 3 or 4 strong costæ on either side of rib and intermediate thinner

ones, short cross-veins prominent, margins setose at least on upper half and approximately parallel most of their length and then rather abruptly narrowed to a setose slender point 1-4 inches long: inflorescence 10 inches long over all, the spathe densely dark brown, acicular, naked inside: fruit in a short rather close cluster (Fig. 81) pendent on an unarmed gooseneck peduncle, nearly globular to obovoid, $\frac{3}{4}$ to nearly 1 inch long and $\frac{5}{8}$ inch

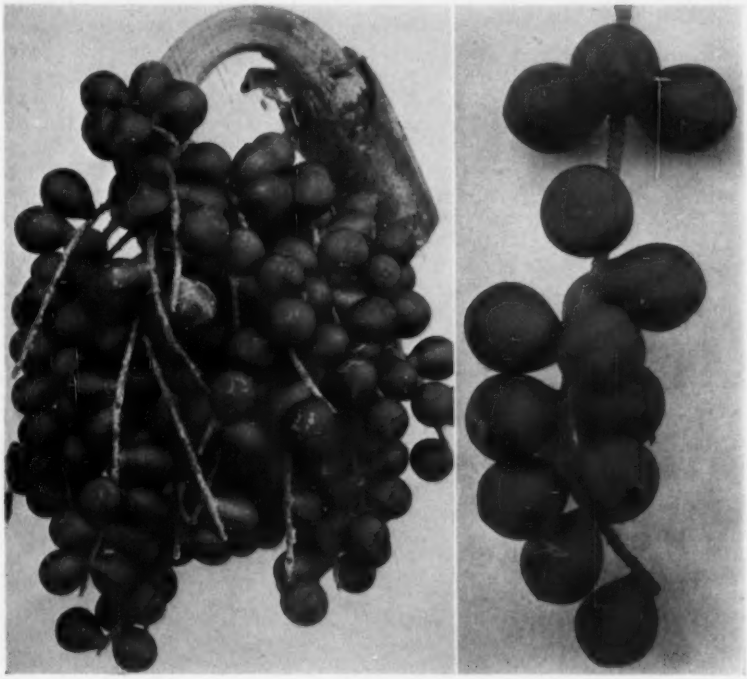

FIG. 81. BEAUTIFUL DEEP ORANGE FRUIT of *Bactris coloradonis*. Cluster × ½; separate a little under-size.

thick, without point, not glossy, glabrous, deep orange, flesh very thin and scarcely juicy; nutlet nearly ½ inch across and somewhat less in height, flat on top, three pores on upper rim, two of them close together on one side; spathe soon breaking away at shank and leaving the fruit-cluster fully exposed.

Woods on Barro Colorado Island; near Allison Armour trail well toward Redwood House; James Zetek trail about station 13; a striking bactrid with the deep orange or red-orange smooth fruit in clusters free of leaves and spathes. It varies somewhat in width of pinnæ and size of fruit; I have described above the broader range of pinnæ.

† **Bactris coloniata,** spec. nov. § Eubactris. Figs. 82-84.

Trunci graciles in apertis gregariisque coloniis, 6 m. alti, 4 cm. in diam. annulati, spinis multis subnigris 4-7 cm. longis: folia interrupte pinnata, pinnæ 15-20 in jugis, pinnæ terminales latissimæ; pinnæ lætevirentes et plerumque nitidæ, 40-60 cm. longæ, 4-7 cm. latæ, tenui-acuminatæ, multis venis, glabræ neque reticulatæ neque aciculares, rachis espinosa, petiolus plus vel minus spinulosa, fulva, divaricata: fructus in spadicibus brevibus pendentibusque, turbinatus, rostratus, durus, ater, circa 2 cm. longus.

Slender palm making large open colonies through which one may walk, the trunks connected by subterranean stems (Fig. 82), mostly 10 or 12 feet but sometimes 20 feet tall; trunk erect, prominently broad-banded, 1½ inches more or less thick; spines brown-black with a bulbous base, to 3 inches long, erect or horizontal on upper trunk and declined on lower parts: leaves bright lively green and usually glossy, interruptedly pinnate (Fig. 83 right), mostly 4 or 5 feet long but sometimes more; petiole slender, 3 feet or more long, semi-terete with a single ridge, more or less furfuraceous, bearing sparse flat light colored short spines toward the base and otherwise unarmed as is also the lightly pubescent or glabrate sharp-angled rachis; pinnæ about 25 subopposite pairs with blanks now and then on lower half, widely spaced (2-3 inches), to 2 feet long and 1¾ inches broad (terminal ones sometimes 2½ inches), rather thin or flexuose, glabrous, the numerous side-veins not very prominent or costate as compared with midrib, without noticeable cross-veins when fresh, margins minutely setulose, tapering toward both ends, gradually narrowed into a slender point 3 or 4 inches long: spathe 10-12 inches long, densely fuscous-setose, unarmed inside, narrowed to a long base, divaricate or at least spreading from the trunk in fruit (Fig. 84): fruit-cluster hanging on an unarmed rather thin not conspicuously flattened peduncle, usually densely laden; fruit turbinate, about 1 inch long and ⅝ inch broad, firm and black, smooth, with abrupt short beak and a marked double crenate and brown-margined high cupule; nut ½ inch across and nearly as high, flattened on top and somewhat narrowed beneath, dark brown, marbled, the three relatively large pores on widest part with two of them close together and other larger one on opposite side.

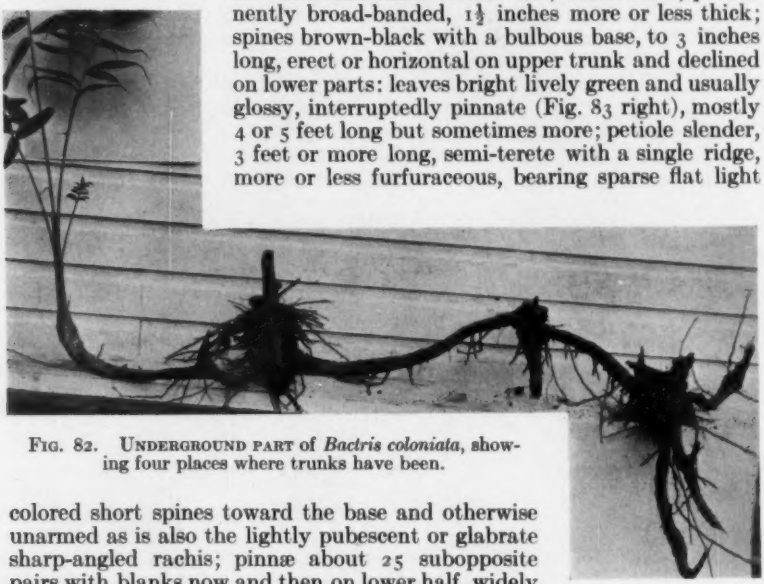

FIG. 82. UNDERGROUND PART of *Bactris coloniata*, showing four places where trunks have been.

"Uvito," the most abundant palm on Barro Colorado Island. Small sterile plants, 2 or 3 feet high, are very common, known from all others by the shining leaves and broad smooth flexible slender-pointed pinnæ.

FIG. 83. CONTRAST OF BACTRID LEAVES. Left, *Bactris superior* with pinnæ continuously placed; right, *B. coloniata* with blank or unoccupied spaces.

It has been supposed that this palm is *Bactris minor;* but Jacquin's description and plate (1763) of that species call for a very different plant and fruit.

At one time I thought this palm to be *Bactris acuminata*, Liebm., a Mexican species; two leaf-parts of Liebmann's collection are in the National Herbarium and they are similar to selected parts of *coloniata* but with marked differences. Diagnosis of *acuminata* calls for petiole unarmed, petiole and rachis acutely bicanaliculate above, pinnæ aggregate and black-aculeate on midrib on under side at base, features that are not in *coloniata;* the figures in Oersted L'Amerique Centrale (t. 8, figs. 32-35) show *acuminata* with a broader fruit and different cupule, lower ring of cupule also not crenate, differing again from *coloniata*. Moeover, the measurements of spathe and spadix as given in Martius are too small for *coloniata*.

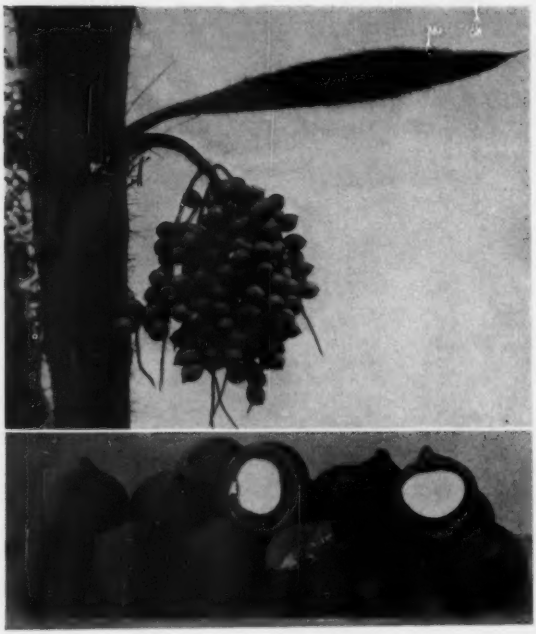

FIG. 84. FRUITS of *Bactris coloniata*. Separate fruits about three-fourths full size.

Bactris no. 521.

Single young sterile plant on Allison Armour trail, Barro Colorado Island, with abundant light colored spines 1-2 inches long on petiole and rachis; foliage much like that of *B. coloniata* but margins more setulose.

Bactris no. 505.

Sterile plants 15 feet high on James Zetek trail and again in deep woods south of Frank M. Chapman trail, Barro Colorado Island, one plant bear-

ing a young spathe-bud 5 inches long thickly covered with flat soft straw-colored spines about ½ inch long and also hair-like ones, with a tomentose setose manubrium: trunk very slender, about 1 inch diameter, closely and prominently ringed, the short spines in separated areas or whorls: leaves very different from any other palm seen on the Island, pinnately interrupted, lively green; pinnæ thin and broad, 8-15 inches long and 2-3 inches broad at middle from which they taper both ways, abruptly acuminate into a very slender point 2-3 inches long, upper ones coalesced to form terminal leaf-lobes to 6 inches broad, secondary nerves ¼-½ inch apart and not costa-like, under surface and armed rachis slightly puberulent; spines nearly white and black-tipped and -based (black on old trunk), flat, 1 inch or less long, sometimes 2 or 3 at one place on the slender narrowly canaliculate puberulent petiole. This plant may be an undescribed species.

FIG. 85. THE ONE FAN-LEAVED PALM of Panama. *Acanthorrhiza Warscewiczii.*

ACANTHORRHIZA

Acanthorrhiza provides the only fan palm known to be native in the Canal Zone. These are hermaphrodite palms (Fig. 87) with interfoliar branching small somewhat fleshy flower-clusters subtended by papery bracts or sheaths; perianth parts and stamens 6; ovary 3-loculed, producing small globular or pyriform fruits without much sarcocarp or pulp, the seed large and single: small trees with single erect trunk (not gregarious), armed only on the bole.

Two recognized species comprise the rootspine palms according to the treatment by Beccari in 1907 (Webbia, ii, 230). The English name arises

from the circumstance that the prominent branched spines on the trunk are interpreted as morphologically roots. One species, *A. Mocinni*, Becc. (*A. aculeata*, Wendl.) is Mexican, the other in Nicaragua, Costa Rica and Panama; it is the latter with which we are now concerned. *A. Kalbreyeri*, Dammer is recently described from Colombia.

The generic name Acanthorrhiza is spelled in the literature with both a single and double *r*, due to the fact perhaps that Wendland, its author, wrote it both ways. The genus begins with double *r* (Acanthorrhiza) in a foot-note in Die Gartenflora, xviii, 241-2 (1869), apparently the first occurrence that can be considered publication. By Wendland it is spelled with one *r* in Kerchove de Denterghem's Les Palmiers, 1878, but there is no description and only the citation of doubtful synonyms to validate it, so that the occurrence is hardly publication in the botanical sense. It appears again by Wendland in Botanische Zeitung, 1879, in a key, spelled *rr*, and even this occurrence is inadequate publication although probably sufficient to establish the genus. It is spelled with double *r* also by Drude in Flora Brasiliensis, 1882 (iii, pt. 2, 554), but by Bentham & Hooker in Genera Plantarum the following year with a single *r* as also by Index Kewensis 1895, and by Post & Kuntze Lexicon 1904. By Dalla Torre & Harms, Genera Siphonogamarum, 1901, the *rr* is revived, but Beccari in his monograph of 1907 spells it the short way and this has been followed subsequently.

FIG. 86. FLOWER-CLUSTER OF ACANTHORRHIZA (× 1/5).

Acanthorrhiza Warscewiczii, Wendl. in Gartenfl. xviii, 241 note (1869) and ex Drude in Martius, Fl. Brasil. iii, 554 in obs., tt. 132, 133 (1882). Figs. 85-88.

A. aculeata, Bot. Mag. t. 7302 (1893) not Wendl., apud Becc.

Trunk rather slender, to 40 feet and sometimes more, not ringed, the surface tuberculate and closely armed with side-branched deflexed but

somewhat upwardly curved spines several inches long and passing into roots near the enlarged base, the upper part of the trunk in exposed places often losing the armature: leaves palmate, soft, to 5 or 6 feet across, at first nearly plane but eventually with more or less pendent segments, light green above, silvery underneath or old leaves in exposed places becoming green underneath; petiole slender, 4-6 feet and more long and mostly less than 1 inch thick, rounded underneath and shallowly broad-channelled above bearing long shreds or fiber at base, hastula (or ligule) short and blunt; segments about 60 on full-sized leaves and most of them parted nearly or quite to the petiole, thin, 2-3 feet long, 1-3 inches broad, apex obscurely bifid, margin entire, midrib strong and many other fine veins with secondary more prominent ones intervening: cluster downward-curved at anthesis (Fig. 86), creamy-white, about 2 feet long, with peculiar odor, velvety paper-like sheaths about 4, ovate-short-pointed, about 6 inches long, becoming ragged and loose as fruit forms, the main axis thick and somewhat fleshy, side-branches 3-6 inches long and again branched, the flowers more or less densely placed: flowers at anthesis about 4 mm. long and 2 mm. or more broad (Fig. 87), nearly globular but slightly tapering, crowned with the 6 close deflexing anthers, sitting on the rachis (not immersed); perianth of 6 parts in two series, the outer (calyx) conspicuously connate at base with obtuse sinuses between them, petals of about the same length and also connate, filaments broadened below and connate, ovaries 3, each with long style about equalling stamens and truncate or small-capitate stigma: fruit oblong-pyriform (Fig. 88), about $\frac{7}{8}$ or 1 inch long and $\frac{5}{8}$ inch broad, smooth.

FIG. 87. STAMINATE FLOWER OF ACANTHORRHIZA (× 4).

FIG. 88. FRUIT of *Acanthorrhiza Warscewczii* (× about 1).

Frequent in woods on parts of Barro Colorado Island but apparently not generally distributed there, known as "escoba"; also elsewhere in the Zone. Trees differ in the armature of trunk; sometimes there are bunches

of roots on the bole. In some cases the bole is very thick in proportion to size of crown, as if the tree were stunted. The pyriform fruit I describe and figure (from Barro Colorado) was nearly hard and apparently full grown, green; I suspect it is white when fully mature; ripe seeds I did not see. I have not found description of the mature fruit. The trees left in clearings with very slender trunk look at a short distance like Thrinax: note Fig. 85.

Palms of Barro Colorado

Aside from a few trees of coconut, the palms known to me on Barro Colorado Island are the following:

Acanthorrhiza Warscewiczii
Astrocaryum Standleyanum
Bactris balanoidea probably
barronis
coloniata
coloradonis
superivr
no. 505
no. 521
no. 529
Chamædorea, probably *Wendlandiana*
Corozo oleifera
Desmoncus, probably *chinantlensis*
Geonoma binervia
decurrens
procumbens
Œnocarpus panamanus
Scheelea zonensis
Socratea durissima
Synechanthus Warscewiczianus

Certain Introduced Palms in Panama: Nomenclature

Aside from the ubiquitous coconut, the most prominent introduced palms are the Roystoneas (Oreodoxa), but we need not consider them here inasmuch as a special Fascicle on the genus is in preparation. Perhaps the next most prominent genus is Pritchardia, which one sees abundantly in some places, as at Corozal. The Revised Catalogue (1930) of the Principal Plants at the Canal Zone Plant Introduction Gardens at Summit lists about sixty generic names. We had the privilege of studying these collections and of obtaining such material as we desired. Many of the plantings are recent.

It is not the intention to discuss the introduced palms, but we may pause to consider such of them as are involved in important shifts in nomenclature, with a view to clarifying the names for persons who may be interested in contemporaneous records.

Because of the adoption of the homonym rule at the International Botanical Congress in 1930 certain of the long-accepted generic names of palms will be replaced unless special action is taken to conserve them. I have placed some of these cases of simple homonyms before the appropriate international committee for action. Other cases, however, may be discussed.

AIPHANES: MARTINEZIA. In 1794 Ruiz & Pavon founded the genus Martinezia, in Peru. In 1804 Willdenow established the genus Aiphanes, in Venezuela. It has been the custom to refer Aiphanes to Martinezia, considering the genus to be indivisible. There have been exceptions to this treatment, however: Karsten in 1856 separated the genus Marara in his study of the Colombian flora; in 1901 O. F. Cook proposed the genera Curima and Tilmia for certain species. A comprehensive survey of the group is now in progress by Burret of Berlin-Dahlem. He separates Aiphanes from Martinezia (Notizblatt Bot. Gart. u. Mus. Berlin-Dahlem, xi, 557 et seq. Dec. 1932). This disposition affects the names of certain species planted in the Canal Zone:

Aiphanes caryotæfolia, Wendl. in Kerchove, Les Palmiers, 230 (1878).
Martinezia caryotæfolia, HBK. Nov. Gen. et Spec. i, 305, t. 699 (1815).
Marara caryotæfolia, Karsten, Fl. Columb. ii, 134, t. 170(1868- 9).
Tilmia caryotæfolia, O. F. Cook in Bull. Torr. Bot. Club, xxviii, 565 (1901).

Aiphanes erosa, Burret in Notizblatt Bot. Gart. u. Mus. Berlin-Dahlem, xi, 558 (1932).
Martinezia erosa, Linden Cat. no. 87 (1871); Gard. Chron. 1872, 1297.

Aiphanes minima, Burret, l. c. (1932).
Bactris minima, Gaertn. Fruct. et Sem. Plant. ii, 269, t. 139, fig. 5 (1791).
Martinezia corallina, Martius, Palmet. Orbig. 76 (1847).
Aiphanes corallina, Wendl. in Kerchove, Les Palmiers, 230 (1878).
Curima corallina, O. F. Cook in Bull. Torr. Bot. Club, xxviii, 563 (1901).

Of the genus Aiphanes (A-íph-anes, four syllables) Willdenow had a single species, *A. aculeata,* of the Caracas region in Venezuela, a plant not yet well understood. I have not seen a palm in cultivation purporting to be this species.

WASHINGTONIA. Although there are two older Washingtonia names than the one employed for the California-Mexican fan palm, 1879, we shall apparently escape damage in this case and not discard a well established

name by the validation of a dubious earlier occurrence. Under the homonym rule one may not exercise choice, but if the earlier name is not technically "published" (*nomen nudum*) it does not exist, and here lies the salvation of Washingtonia.

The name *Washingtonia californica* for one of the Sequoias, 1854, is now considered not to have been published. Washingtonia for the genus Osmorhiza, 1818, should also be so considered. In many marginal cases opinions may differ as to whether a certain name is a *nomen nudum*, *subnudum*, *dubium* or *incertum*. Rafinesque mentioned the name Washingtonia along with Osmorhiza, saying that it had not been published and that the latter is perhaps better, and the following year he regularly published the latter, yet Washingtonia has been adopted merely because mentioned first (Gent. Herb. ii. 432). It illustrates again the particular pains we seem to take to validate names of Rafinesque whereas many of them should be dismissed out of hand as *nomina inutilia*. The name Neowashingtonia was proposed by the late George B. Sudworth in 1897 to avoid contact with the Rafinesquean Washingtonia, but it is comforting to know that thirty years later he abandoned it (Check List of the Forest Trees, etc., Misc. Circ. 92, U. S. Dept. Agr.); also that Washingtonia is retained for the palm by Abrams, in Illustrated Flora of the Pacific States, 1923. In Rydberg's recent Flora of the Prairies and Plains, the umbelliferous name Washingtonia is reduced to synonymy under Osmorhiza.

EUPRITCHARDIA: PRITCHARDIA. In Bonplandia for 1861 Seemann & Wendland proposed the genus Pritchardia and species *P. pacifica* for a palm of the Fiji Islands; the entry was without diagnosis, but vernacular names were cited. In the same publication the following year the name was given full diagnosis (x, 197), from which the genus must be dated; and later in the volume Seemann published an extended account, with a plate (page 309 et seq. t. 15).

The name Pritchardia is preoccupied, however, by Pritchardia of Unger, 1840, a paleobotanical genus, regularly published; this early name automatically under the rules displaces the later one of Seemann & Wendland. To avoid this conflict, Drude renamed the fossil genus Pritchardioxylon (Nachtr. Engler & Prantl, Natur. Pflanzenfam. 50. 1897), but this procedure is not allowable. Otto Kuntze (Revisio Gen. Plant. ii, 737. 1891) met the situation by accepting Drude's disposition in Pflanzenfamilien, 1889, of combining the genera Pritchardia and Washingtonia but used the latter generic name and thus allowed Unger's Pritchardia to hold; he made combinations of the known specific names under Washingtonia. Seven years later (Revisio, iii, 323) Kuntze separated Washingtonia and Pritchardia, and because of the older use of Pritchardia by Unger he pro-

posed Eupritchardia for the Pacific Islands palms and transferred the specific names. In 1915 O. F. Cook, noting that "it has long been known that the name Pritchardia is incorrectly applied to the Pacific island palms," proposed the generic name Styloma and transferred the specific names at that time published. It is apparent that Eupritchardia must be employed for the palm genus, but Pritchardia will undoubtedly continue as a popular name.

Many species of Eupritchardia have now been described (see page 23, fasc. i), but probably the plants growing on the Isthmus are all *E. pacifica*. The citation of this species may be stated as follows:

Eupritchardia pacifica, O. Kuntze, Rev. Gen. Pl. iii, 2, p. 323 (1898).
Pritchardia pacifica, Seemann & Wendl. in Bonplandia, x, 197 and 310, t. 15 (1862).
Washingtonia pacifica, O. Kuntze, Rev. Gen. Pl. ii, 737 (1891).
Styloma pacifica, O. F. Cook in Journ. Wash. Acad. Sci. v, 241 (1915).

STEVENSONIA (*S. grandifolia*), Duncan, Cat. Roy. Bot. Gard. Mauritius, 1863, *nomen;* Veitch, Proc. Royal Hort. Soc. Lond. iv, 134 (July 1864), with award of first certificate for plant on exhibition (Stephensonia), and Hogg, Gardeners' Year-Book, 1864 (1865), p. 52; see also other references in connection with Bot. Mag. t. 7277.
Phœnicophorium sechellarum, Wendl. in Ill. Hort. xii, misc. 5, t. 5 (Feb. 1865).

Stevensonia Borsigiana, Bailey, Gent. Herb. ii, 192 (1930).
Astrocaryum Borsigianum, Koch, Wochenschrift Gärt. u. Pflanzenk. 401; Gartenfl. 1861, 29.
Phœnicophorium Borsigianum, Stuntz, Inventory Seed and Plant Import. no. 31, p. 88, Bur. Pl. Ind., U. S. Dept. Agr. (1914).

The title of this attractive Seychelles palm (of which I have leaf specimens from the Plant Introduction Gardens at Summit), both as to generic and specific names, must await study of the plant itself, from undoubted authentic sources, particularly in the juvenile state in which it was first illustrated; assembling of information of this kind is now in progress; it may turn out to be a question of identification as well as of nomenclature.

As a formal nomenclatorial procedure the generic name Phœnicophorium has the advantage because accompanied by a technical description. The horticultural history under Stevensonia has continuous standing; seedsmen's seeds under that name and answering the original diagnosis and drawings are still in the market. The nomenclatorial history is traced in Gentes Herbarum, ii, 192 and again on page 438 et seq.

For the present, at least, I prefer the generic name Stevensonia. Its history leaves much to be desired, but in this respect it is not singular. Many names are stabilized on incomplete evidences. It is better than many Rafinesquean names that we take so much trouble to adopt.

The diagnosis of Phœnicophorium by Wendland is not accompanied by reference to figures; the illustration in L'Illustration Horticole, comprising a full-page colored plate of a young plant and details of fruit (t. 433), is dated April, 1865, whereas the diagnosis is dated February; probably Wendland had in hand the fruits figured on the plate; he may have seen the plate in advance of publication although in that case he probably would have cited it. He did not describe inflorescence or flowers. Text accompanying the plate states: "M. H. Wendland a cru devoir prendre cette plante pour le type d'un nouveau genre; et en justifie la création par les figures analytiques du fruit qu'il a fait dessiner avec soin sous ses yeux, et que nous reproduisons sur la belle planche ci-contre." (See, also, reference opposite t. 430). I feel impelled to make this explanation in extension of my discussion of last December (Gent. Herb. ii, 438), inasmuch as that statement was not complete due to change in proof at the last moment and which was not discovered until a few hours after the copies were placed in the mails.

In my paper of December, just cited, I quoted George V. Nash to the effect that, at his writing in 1902 about the Phœnicophorium that bloomed at the New York Botanical Garden, no previous record had been found of the flowering of the plant in cultivation; he quoted William Watson of Kew in substantiation. Yet in the Botanical Magazine account of 1893 (t. 7277) is record of its blooming at Kew. In that account mention is made of the differences between old and young plants being so great that "Mr. Watson observes that it is hardly credible that they form but one species."

The meaning of all these disharmonies (part of which are not mentioned here) probably can not be disclosed from citation of literature alone.